NATIONAL INSTITUTE FOR HEALTH AND WELFARE

Maija-Liisa Rummukainen

Antimicrobial Use and Infections in Finnish Long-Term Care Facilities

RESEARCH

110

RESEARCH NR 110 • 2013

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Antimicrobial Use and Infections in Finnish Long-Term Care Facilities

ACADEMIC DISSERTATION

To be presented with the permission of the Faculty of Medicine, University of Helsinki, for public examination in Auditorium 2, Biomedicum, Haartmaninkatu 8, on August 31st 2013, at 12 noon

National Institute for Health and Welfare, Helsinki, Finland
and
Medical Faculty, University of Helsinki, Finland

Helsinki 2013

NATIONAL INSTITUTE
FOR HEALTH AND WELFARE

Cover photo: Antero Aaltonen

ISBN 978-952-245-916-9 (printed)
ISSN 1798-0054 (printed)
ISBN 978-952-245- 917-6 (online publication)
ISSN 1798-0062 (online publication)
http://urn.fi/URN:ISBN:978-952-245-917-6

Juvenes Print – Finnish University Print Ltd
Tampere, Finland 2013

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To my mother

Abstract

Maija-Liisa Rummukainen, Antimicrobial Use and Infections in Finnish Long-Term Care Facilities, National Institute for Health and Welfare. Research 110. 116 pages. Helsinki, Finland 2013. ISBN 978-952-245-916-9 (printed); ISBN 978-952-245-917-6 (online publication)

Background and aims. The rapidly growing ageing population results in a demand for new types of housing that may face the same challenges as nursing homes (NHs) do today. Elderly persons are at particular risk for healthcare-associated infections, since few long-term care facilities (LTCFs) have in-house expertise in infection control or in infectious diseases. This may lead to inappropriate prescription of antimicrobials and promote development of multidrug-resistant bacteria. The movement of residents between LTCFs and acute-care hospitals facilitates the spread of resistant bacteria. The aim of the present study was to determine the use of antimicrobials and prevalence of infections in LTCFs in Finland. An additional aim was to evaluate the feasibility of different methods in assessing antibiotic use and prevalence of infections in LTCFs.

Methods. A team comprising an infectious disease consultant, an infection control nurse, and a geriatrician visited all 123 LTCFs for elderly persons in the Central Finland Healthcare District during 2004–2005. The site visits consisted of a structured interview concerning patients, ongoing systemic antimicrobial use, diagnostic practices for urinary tract infection (UTI), and monthly amount in liters of alcohol-based hand rubs used and in patient-days. Following the visits, regional guidelines for prudent use of antimicrobials in LTCFs were published and the use of antimicrobials was followed up by an annual questionnaire during 2006-2008.

All residents present in nine voluntary NHs for $\geq$ 24 hours (n = 5,791) and receiving systemic antimicrobials on the day of the survey were included in the study. Data on antibiotics and their indications (prophylaxis or treatment, type of infection) were collected in April and November 2009 and May-September 2010.

All residents for whom a Minimum Data Set (MDS) form (n = 12,784) was completed in 753 LTCFs using a Resident Assessment Instrument (RAI) in April and September 2011 were included.

Results. The proportions of patients receiving antimicrobials in surveys varied between 10% and 19%. Most of the antimicrobials were used for UTI prophylaxis (42-69%) and treatment (13-25%). The proportion of patients on UTI prophylaxis decreased in the Central Finland Healthcare District from 13% to 6% and in eight NHs from 12% to 6%. The most common antimicrobial used was methenamine (36-44%), followed by trimetoprim (14-31%), cephalexin (6-9%), and pivmecillinam (6-11%). In Central Finland Healthcare District LTCFs, the total amount of alcohol-

based hand rub used increased by 70%, from the mean (SD) of 7.3 (5.1) L/1000 patient-days on the baseline visit in 2005 to 12.4 (14.9) L in 2008.

In LTCFs using RAI, the risk factors for antimicrobial prescription included female sex, age < 85 years, urinary catheter, urinary incontinence, confusion, restriction to bed, pressure ulcers, diarrhea, and hospital stay during the previous 90 days.

Conclusions. Antimicrobial use was common in Finnish LTCFs and most were used for UTI prophylaxis and treatment. The decrease in antimicrobial usage during the surveys suggests that LTCFs may benefit from antimicrobial stewardship interventions focused on UTI. The multidisciplinary team succeeded in promoting hand hygiene in LTCFs, which was sustained over the 3-year follow-up. RAI with MDS data also constitutes a feasible tool for collecting data on antibiotic use and infections in LTCFs.

Keywords: long-term care facility, prevalence survey, antimicrobial use, resident assessment instrument, minimum data set

Tiivistelmä

Maija-Liisa Rummukainen, Antimicrobial Use and Infections in Finnish Long-Term Care Facilities [Mikrobilääkkeiden käyttö ja infektioiden esiintyminen pitkäaikaishoitolaitoksissa Suomessa]. Terveyden ja hyvinvoinnin laitos. Tutkimus 110. 116 sivua. Helsinki, 2013. ISBN 978-952-245-916-9 (painettu); ISBN 978-952-245-917-6 (verkkojulkaisu)

Ikääntyneet ihmiset ovat erityisen alttiita saamaan hoitoon liittyviä infektioita. Pitkäaikaishoitolaitoksissa ei välttämättä ole asiantuntemusta hoitoon liittyvistä infektioista ja niiden ennaltaehkäisystä. Mikrobilääkkeiden runsas käyttö johtaa lääkkeille vastustuskykyisten bakteerien kehittymiseen ja leviämiseen. Asukkaiden siirrot akuuttisairaaloihin ja takaisin lisäävät lääkkeille vastustuskykyisten bakteerien leviämistä.

Tutkimuksessa selvitettiin mikrobilääkkeiden käyttöä ja infektioiden esiintymistä pitkäaikaishoitolaitoksissa. Samalla arvioitiin eri menetelmien käyttökelpoisuutta mikrobilääkkeiden käytön ja infektioiden esiintymisen selvittämiseksi pitkäaikaishoitolaitoksissa. Tutkimuksessa pitkäaikaishoitolaitos tarkoittaa laitosta, jossa hoitaja on paikalla 24 tuntia vuorokaudessa.

Moniammatillinen ryhmä vieraili kaikissa pitkäaikaishoitolaitoksissa (n=123) Keski-Suomen sairaanhoitopiirin alueella 2004–2005. Tutustumiskäynneillä henkilökunnalle tehtiin strukturoitu haastattelu, joka koski potilastietoja: sillä hetkellä käytössä olleet mikrobilääkkeet, virtsatieinfektion diagnosointi ja kuukausittainen käsihuuhdekulutus. Vierailujen jälkeen laadittiin alueelliset ohjeet mikrobilääkkeiden käytöstä pitkäaikaishoitolaitoksille. Tämän jälkeen seurattiin vuosittain 2006–2008 kirjekyselyllä mikrobilääkkeiden käyttöä ja käsihuuhteen kulutusta.

Toiseksi tutkittiin pisteprevalenssitutkimuksella yhdeksän vapaaehtoisen vanhainkodin asukkaiden (n=5,791) mikrobilääkkeiden käyttöä: ennaltaehkäisy tai hoito sekä infektiotyyppi. Tiedot kerättiin huhtikuussa ja marraskuussa 2009 ja touko-syyskuussa 2010.

Yksilöpohjainen arviointimenetelmä RAI (Resident Assessment Instrument) koostuu arviointilomakkeesta nimeltä MDS (Minimum Data Set). RAI järjestelmän avulla seurataan hoidon laatua ja vaikuttavuutta yksilö- ja laitostasolla. Kolmanneksi analysoitiin 753 pitkäaikaishoitolaitoksen MDS arviointilomakkeen (n=12,784) infektio- ja mikrobilääketietoja syyskuulta 2011.

Mikrobilääkkeitä käytti 10–19 % pitkäaikaishoitolaitosten asukkaista. Suurin osa mikrobilääkkeistä käytettiin virtsatieinfektioiden estoon (42–69 %) ja hoitoon (13–25 %). Virtsatieinfektioiden estolääkitys väheni Keski-Suomen sairaanhoitopiirin alueella 13 %:sta 6 %:iin ja kahdeksassa vanhainkodissa 12 %:sta 6 %:iin. Eniten käytetty mikrobilääke oli metenamiini (36–44 %), seuraavana trimetopriimi (14–31 %), kefaleksiini (6−9 %) ja pivmesillanaami (6−11 %).

Keski-Suomen sairaanhoitopiirin alueen pitkäaikaishoitolaitoksissa käsihuuhteen käyttö lisääntyi 70 %:lla, keskiarvosta (keskihajonta) 7.3 (5.1) litraa/1000 potilaspäivää laitosvierailujen aikana 12.4 (14.9) litraan/1000 potilaspäivää vuonna 2008.

Pitkäaikaishoitolaitokset, joissa RAI arviointimenetelmä oli käytössä, riskitekijät mikrobilääkkeiden käytölle olivat: naissukupuoli, ikä alle 85 vuotta, virtsatiekatetri, virtsan pidätyskyvyttömyys, sekavuus, vuodepotilas, painehaavat, ripuli ja sairaalahoitojakso edeltävän 90 vuorokauden aikana.

Yhteenvetona mikrobilääkkeitä käytettiin suomalaisissa pitkäaikaishoitolaitoksissa enemmän kuin eurooppalaisissa laitoksissa. Yleisimmin niitä käytettiin virtsatieinfektioiden ennaltaehkäisyyn ja hoitoon. Virtsatieinfektioiden ehkäisyyn käytettyjen mikrobilääkkeiden määrä väheni tutkimuksen aikana.

Pitkäaikaishoitolaitokset voivat hyötyä erityisesti virtsatieinfektioiden ennaltaehkäisyn ja hoidon ohjeistamisesta. Moniammatillinen ryhmä onnistui lisäämään käsihuuhteen käyttöä pitkäaikaishoitolaitoksissa. Tulos säilyi kolmen vuoden seurannan ajan. RAI yksilöpohjainen arviointilomake (MDS) osoittautui käyttökelpoiseksi työkaluksi kerättäessä tietoja mikrobilääkkeiden käytöstä pitkäaikaishoitolaitoksissa.

Avainsanat: pitkäaikaishoitolaitos, mikrobilääkkeiden käyttö, prevalenssitutkimus, RAI arviointimenetelmä

Contents

List of original papers

This thesis is based on the following original articles referred to in the text by their Roman numerals:

I Rummukainen M, Jakobsson A, Karppi P, Kautiainen H, Lyytikäinen O. Promoting hand hygiene and prudent use of antimicrobials in long-term care facilities. Am J Infect Control 2009;37:168-71.

II Rummukainen ML, Jakobsson A, Matsinen M, Järvenpää S, Nissinen A, Karppi P, Lyytikäinen O. Reduction in inappropriate prevention of urinary tract infections in long-term care facilities. Am J Infect Control 2012;40:711-4.

III Rummukainen ML, Jakobsson A, Matsinen M, Karppi P, Järvenpää S, Lyytikäinen O. Three-year sustainability of alcohol-based hand rub use increase in Finnish long-term care facilities. Int J Infect Control 2011;v8:i1 doi:10.3396/ijic.v8i1.008.

IV Rummukainen ML, Kärki T, Kanerva M, Haapasaari M, Ollgren J, Lyytikäinen O. Antimicrobial prescribing in nursing homes in Finland: results of three point prevalence surveys. Infection 2013;41:355-60. doi: 10.1007/s15010-012-0331-9.

V Rummukainen ML, Mäkelä M, Noro A, Finne-Soveri H, Lyytikäinen O. Assessing prevalence of antimicrobial use and infections using the minimum data set in Finnish long-term care facilities. Am J Infect Control 2013;41:35-7. doi:10.1016/j.ajic.2012.09.007.

Abbreviations

APIC	Association for Professionals in Infection Control and Epidemiology
ATC	Anatomical therapeutic chemical
BSI	Bloodstream infection
CDC	Center for Disease Control and Prevention, USA
CI	Confidence interval
DDD	Defined daily dose
DVD	Digital video disk
ECDC	European Centre for Disease Prevention and Control
ESAC	European Surveillance of Antimicrobial Consumption
ESBL	Extended-spectrum beta-lactamase
EU	European Union
HAI	Healthcare-associated infection
HALT	Healthcare-Associated infections in Long-Term care facilities
IC	Infection control
IPSE	Improving Patients Safety in Europe
IRR	Incidence rate ratio
KESLAB	Central Finland Healthcare District laboratory
LRTI	Lower respiratory tract infection
LTAC	Long-term acute care
LTC	Long-term care
LTCF	Long-term care facility

MDR	Multidrug-resistant
MDS	Minimum Data Set
MRSA	Methicillin-resistant *Staphylococcus aureus*
NH	Nursing home
OR	Odds ratio
PPS	Point prevalence survey
RAI	Resident assessment instrument
RAI-LTCF	
version 2.0	Resident assessment instrument for long-term care facilities version 2.0
RTI	Respiratory tract infection
RYMY	Food poisoning outbreak reporting system
SD	Standard deviation
SHEA	Society for Healthcare Epidemiology of America
UTI	Urinary tract infection
VRE	Vancomycin-resistant enterococci
WHO	World Health Organization

1 Introduction

In Finland (population 5.37 million), the national healthcare system is organized into 20 geographically and administratively defined healthcare districts, with populations ranging from 67,800 to 1.7 million. At the municipality level, healthcare centers run by local general practitioners provide primary care. Healthcare center hospitals have both short- and long-term beds. In addition, long-term care (LTC) for elderly persons is given by nursing homes (NHs), dementia units or sheltered housing, depending on the patient's physical, psychiatric and behavioral condition [1]. Sheltered housing provides round-the-clock care in more home-like environment than NHs.

By late 2000 there were 177,000 persons 80 years of age and over in Finland and in late 2010 the corresponding figure was 256,000 persons [2]. In late 2010 in Finland, the number of residents in NHs was 16,082 and in sheltered care units with 24-hour assistance 28,644 [3]. The number of residents in NHs fell about 6% and increased in sheltered care units with 24-hour assistance by 11.5%. The average age of the residents was 83.2 years. Women accounted for 72.3%. In healthcare-center hospitals in 2010, there were 8,174 clients in LTC; this was 18.1% less than in 2009.

Rapidly ageing populations result in increasing demand for LTC worldwide [4]. Long-term care facility (LTCF) residents are at particular risk for healthcare-associated infections (HAIs) [5]. The frequent movement of residents between LTCFs and acute hospitals facilitates the spread of resistant microbes [5]. In elderly persons, diagnoses of infections are often difficult, which may easily lead to inappropriate prescription and increased use of antimicrobials with the potential for development and spread of multidrug-resistant bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA) and extended-spectrum beta-lactamase (ESBL) -producing *Enterobacteriaceae* [6]. Hand hygiene is the most important means of preventing HAIs and transmission of multidrug-resistant bacteria [7].

In LTCFs, antimicrobials are often prescribed over the phone, based on a nurse's description of the clinical condition of a patient without any diagnostic testing [8-10].

Most studies on antimicrobial prescription in LTCFs were conducted in the USA, while several were from Europe, the first of which came from Norway [11]. The report of the two European Surveillance of Antimicrobial Consumption (ESAC) nursing home (NH) subgroup point prevalence surveys (PPSs) showed that the prevalence of antibiotic prescription was high in NHs in Finland compared with NHs elsewhere in Europe (13% vs 5%) [12].

Urinary tract infections (UTIs) are the most common reason for prescribing antibiotics in LTCFs [13, 14]. Of systemic antimicrobial courses, 0–80%, were used for UTI in European countries [13]. UTI may not be clinically evident in some

patients. Asymptomatic bacteriuria is commonly found among older LTCF residents [14]. These residents do not benefit from antimicrobial treatment for asymptomatic bacteriuria [14].

The purpose of this study was to assess the prevalence of antimicrobial prescriptions and infections in LTCFs in Finland and to evaluate the feasibility of surveying antimicrobial use and infections in LTCFs. Antimicrobial prescriptions and infections in LTCFs has not been surveyed before in Finland.

2 Review of the literature

2.1 Healthcare-Associated infections in Long-Term care facilities

HAIs are localized or systemic conditions resulting from adverse reactions to the presence of an infectious agent or its toxin. There must be no evidence that the infection was present or incubating at the time of admission to the acute-care setting [16]. HAIs are a major public health concern contributing to increased morbidity, mortality, and healthcare costs [17]. European Centre for Disease Prevention and Control (ECDC) estimated the number of patients acquiring HAIs in acute care in the European Union (EU) as 4.1 million each year, with approximately 37,000 deaths directly attributable to these infections [18]. About 50,000 patients undergo hospitalization for HAIs in Finnish acute-care hospitals annually while around 700 HAI patients with no fatal underlying disease were deceased [19]. Based on HALT surveys in European LTCFs the total number of HAIs was estimated as 2.6 million each year [20]. No such estimates are available from Finland.

The proportion of the population > 65 years of age is increasing and the number of patients in LTCFs has surpassed the number of patients in acute-care hospitals [21]. As the population ages and technology improves in care of patients with previously fatal conditions, the number of residents in LTCFs increases. The acute-care hospital stays are shorter. The residents in LTCFs have more complicated medical conditions. In the USA, a new type of healthcare setting, long-term acute care (LTAC), has been established in which intensive care is given for extended period of time [22]. Institutional transfers pose a high risk for HAIs in LTCFs. In Canada, a visit to the emergency department resulted in a more than threefold increased risk of acute gastrointestinal and respiratory infection among LTCF residents [23]. The total number and rate of HAIs in LTCFs may be comparable to that in acute-care hospitals [20].

2.2 Risk factors for healthcare-associated infections in elderly persons

Aging is associated with immune dysfunction [24-28]. Elderly persons suffer from chronic disorders that affect host resistance to infections (Table 1). Older adults are at risk for malnutrition [30]. Malnutrition is associated with immune defects [31, 32]. Morbidity and mortality from infections are higher than among younger adults. Several factors contribute to this: reduced physiologic reserve capacity, decreased host resistance, chronic underlying diseases, delays in diagnosis and therapy, poor tolerance to invasive diagnostic and therapeutic procedures, and higher risk of adverse reactions to drugs [29].

Table 1. Changes that may promote infections in older people

Skin	Epidermal thinning, decreased elasticity, decreased subcutaneous tissue, decreased vascularity, decreased wound healing
Respiratory tract	Decreased cough reflex, diminished immunoglobulin A levels, loss of elastic tissue, decreased mucociliary transport, increased gram-negative colonization of oropharynx
Urinary tract	Hormonal changes, prostate enlargement, decreased prostatic secretions, increased bacterial adherence to uroepithelial cells
Gastrointestinal tract	Decreased gastric acidity and motility
Immune system	Decreased antibody production, decreased T cell count, increased autoantibodies
Chronic illness	Diabetes, congestive heart failure, vascular insufficiency, chronic obstructive pulmonary disease, neurologic impairment, dementia
Nutritional impairment	Decreased cell-mediated immunity and wound healing
Functional impairment	Immobility, incontinence, impaired cognitive status, poor hygiene
Invasive devices	Indwelling urinary catheter, tracheostomy, feeding tube gastrostomy, central venous catheter
Medications	Depress the level of consciousness, cause urinary retention, decrease gastric acidity, reduce immune function, colonization with resistant organism
Institutionalization	Increased person-to-person contact

Modified from Mayhall GC Hospital Epidemiology and Infection control [32]

2.3 Infections in long-term care facilities

The etiologies of endemic infections in LTCFs are a mixture of classic community-acquired and healthcare-associated pathogens [26,33].

2.3.1 Urinary tract infections

UTI is the most common reason for prescribing antibiotics in LTCF [12-14]. The diagnosis of UTI is difficult. The diagnostic criteria for UTI vary among institutions and prescribers. Asymptomatic bacteriuria is commonly found among elderly LTCF residents [26]. In reports from the USA, the prevalence in females has been as high as 18–57% and in males 19–38% [34].The residents do not benefit from antimicrobial treatment for asymptomatic bacteriuria [14,34]. Therefore it should not be looked for or treated [35]. In LTCFs, any clinical change without localizing symptoms or signs is often considered to be symptomatic for UTI [36]. Treatments for other infections and diseases may be delayed if symptoms are too easily believed to be from UTI [36]. Dysuria and change in the character of urine or change in mental status were the only clinical symptoms associated with bacteriuria plus pyuria in residents with clinically suspected UTIs [36]. Residents with chronic urinary catheters have increased risk for infection [37].

2.3.2 Clostridium difficile

Clostridium difficile has been increasingly identified as the most common infectious cause of acute diarrheal illness in NHs [38]. The prevalence of *C. difficile* colonization in the absence of an outbreak has ranged from 4% to 20% [38,39].The rate of acquisition of *C. difficile* during a year follow-up in an LTCF was 0.52/1000 resident-days [39]. The prevalence of *C. difficile*-associated diarrhea was greater in units where the majority of patients were admitted from hospital settings. The risk factors for acquiring *C. difficile* in an NH are antibiotic use, nasogastric or gastrostomy feeding tube, fecal incontinence, and use of proton pump inhibitors [40]. In NHs in Finland 22% of the residents were prescribed proton pump inhibitors [41]. In the USA about 6% of NH residents received enteral feedings [42].

Transmission of *Clostridium difficile* likely occurs by direct spread from the hands of personnel, fomites, or the NH environment.

2.3.3 Respiratory tract infections

Pneumonia is the leading cause of mortality and transfer to acute-care facilities among residents in LTCFs [43, 44]. Mortality rates may reach as high as 50%. The incidence of pneumonia in LTCFs was 0.3 -2.5/1000 resident-days [45]. This varies in relation to the season [45, 46]. In LTCFs, chest radiography is rarely taken [40]. The diagnosis is made clinically. It is often delayed, due to the frequent absence of fever, the paucity or absence of cough, and changes in mental status [26]. A study in

Germany indicated that residents with pneumonia were more likely to die than residents with other HAIs [47]. Vergis and colleagues observed in a case-control study that pneumonia in LTCF residents was associated with excess mortality for up to 2 years [44].

2.3.4 Skin infections

The most common skin infections are wound infections (pressure ulcers and other types of wounds) [48]. Prevalence of pressure ulcers varied between 2.2-24% [49, 50]. Scabies can be transmitted from patient to patient on the hands of healthcare personnel [50]. Crusted scabies is very infectious and causes epidemics in LTCFs [51].

2.3.5 Bloodstream infection

Bloodstream infection (BSI) is a major cause of morbidity and mortality among elderly peoples [52]. BSI has been infrequently studied in the LTC population. Blood cultures are rarely performed in LTC settings. Incidence of BSI was 0.04-0.3 episodes/1000 resident-days. Residents in LTCFs have few venous catheters. Urinary catheters are more popular. UTI was the most common source of the infections. *Eschericia coli*, *Providencia* sp and *Proteus* sp were the most common causative microbes [52].

2.4 Antimicrobial resistance

Increasingly, antimicrobial resistance has become a problem in LTCFs worldwide [53,54]. LTCF residents may be an important reservoir for multi-resistant organisms such as methicillin-resistant *Staphylococcus aureus* (MRSA) and extended-spectrum beta-lactamase (ESBL) -producing *Enterobacteriaceae* [54-56]. LTCF residents are often colonized with resistant organisms. Clinical infections with these resistant organisms are less common than in acute-care settings [54]. LTC residents are able to transmit these organisms when they are transferred to acute-care hospitals [57].

2.4.1 Methicillin-resistant *Staphylococcus aureus*

MRSA may be a problem for residents in NHs. MRSA prevalence differs in LTCFs in various European countries from 1.1% to 37.6% [55,58]. The residents live in close proximity to each other; and they may have a high number of medical conditions. They may receive several prescriptions for antibiotics, and may have pressure ulcers and catheters. Fluoroquinolone use has been confirmed as a risk factor for MRSA [55, 59,60]. An emerging problem of MRSA in LTCFs in Finland has already been documented, starting in 2001 [61].

2.4.2 Vancomycin-resistant enterococci (VRE)

VRE rarely spread or cause infection among residents in LTCFs [54]. VRE were more common colonizers in acute-care facilities than in LTCFs. LTC patients colonized with VRE were more likely than controls to have been in an acute-care facility [53,62,63].

2.4.3 Highly resistant gram-negative organisms

Multidrug-resistant gram-negative organisms are emerging as the most important pathogens among LTCF residents [53]. In the USA the prevalence of multidrug-resistant gram-negative organisms increased significantly from 7% in 2003 to 13% in 2005 [54]. In the USA in 2011, an outbreak due to carbapenem-resistant *Klebsiella pneumoniae* was detected in an LTCF [64]. In an LTCF (n=120) in Italy, 64% of residents were colonized with ESBL producers and 6.3% with metallo-ß-lactamase producers [65]. In Northern Ireland, MDR *Escherichia coli* was cultured from 40.5% of the fecal specimens from 294 NH residents in 20 NHs [66]. In three LTCFs (n=164) in Australia, 12% of the residents were colonized with ESBL-producing *E. coli* [67]. In nine Swedish NHs residents (n=560) the ESBL carrier rate was 3.0% [68]. A study in Italy showed that prolonged use of quinolones and third-generation cephalosporins increases the risk of UTI caused by ESBL-producing *Enterobacteriaceae* [57].

2.5 Outbreaks

Influenza and norovirus outbreaks are fairly common in LTCFs [45,48]. Large numbers of outbreak reports are not even published [69]. Outbreak reports may add important information to the understanding of transmission of infections and infection control [29]. The list of outbreak -causing pathogens is growing [29].

Gastmeier and colleagues developed a systematic register of healthcare-associated outbreaks to assist in quick overviews. The database is regularly updated and freely accessible (http://www.outbreak-database.com) [70]. At the time of the search on February 20, 2012, the outbreak database contained information on 2,756 outbreaks, of which 201 were from NHs. The most common causes of outbreaks in NHs were influenza virus (32), MRSA (22), *Salmonella* sp. (20), norovirus (20), hepatitis B (18), group A *Streptococcus* (10), pneumococci (9), scabies (9), and rotavirus (6).

Utsumi and collagues found in MEDLINE 1966-2008 a total of 207 published articles on epidemics in NHs [71]. The commonest etiologic agents were influenza viruses (49), noroviruses (25), *Salmonella* sp (16), Group A streptococci (16), scabies (11), *Clostridium difficile* (8), *E coli* (8), and pneumococci (8).

In France since 2006, an early reporting system of lower respiratory tract infection (LRTI) outbreaks in NHs to local public health authorities has been used in order to reduce the morbidity and mortality associated with these events [72].

Between August 2006 and July 2007, 64 outbreaks were reported. In more than 30% of the episodes influenza virus was detected. When control measures were implemented more than 2 days after the onset of the first case, the duration of the outbreak was longer (16.4 days vs. 8.3 days) and more residents had LRTI. Reporting created a dialog between NH and public health professionals that facilitated outbreak management [72].

2.6 Surveillance

Surveillance including feedback is a crucial part of infection control activities [73]. Studies of HAIs in LTCFs were initiated in 1980. The first published papers were from the USA [74]. The first European studies originated from Norway [11]. The ESAC-NH subgroup and HALT projects have inspired European LTCFs to perform PPSs [12].

2.6.1 Definitions of healthcare-associated infections

The Center for Disease Control and prevention (CDC) definitions for acute care are not suitable as such for LTCFs, because diagnostic facilities are very limited in most LTCFs. Modified CDC definitions have been used in LTCF surveys (Norway, the Netherlands) [11,75]. McGeer and collagues developed definitions for HAIs in LTCFs [76]. These criteria are used in most surveys in LTCFs. The McGeer criteria were recently revised [77]. Specific criteria for norovirus and *Clostridium difficile* infection were added to the gastrointestinal infections. The definition for UTI differs from the original. UTI is diagnosed when there are localizing genitourinary signs and symptoms and a positive urine culture result.

2.6.2 Prevalence surveys of healthcare-associated infections

There are 28 published prevalence surveys of HAI in LTCFs from eight countries (Table 2). Two of the surveys are from the USA, the rest from Europe. The largest survey with 44,869 residents was from France. The overall prevalence of HAI varied between 2.6% and 11.5%. The prevalence of UTI was 0.7-3.8%, respiratory tract infection (RTI) 0.6-4.7% and skin infection 0.8-1.3%.

The results are rather similar with European acute hospital data (3.5-9.5%) [18]. In Finnish acute-care hospitals the prevalence of HAI was 8.5% [88].

Table 2. Prevalence surveys on healthcare-associated infections in long-term care facilities

Country Publication year	Year	Number of surveys	Number of facilities	Number of residents	Prevalence (%)	Definitions/Remarks	Reference
Norway 2000	1997, 1998, 1999	3	65–70	4,400–5,000	6.4–6.7	Modified CDC criteria UTI 2.9, Skin infection 1.3, LRTI 0.7	[11]
Italy 2007	2001	1	49	1,926	8.4	McGeer criteria RTI 27%, Skin infection 27%, Conjunctivitis 16%, UTI 12%	[78]
Norway 2004	2002, 2003	4	203–323	11,465–17, 174	6.6-7.6	CDC criteria UTI 50%, Skin infection 25%, LRTI 19%, SSI 5%,	[79]
USA 2008	2005	1	133	11, 475	5.2	Modified CDC criteria, Risk factor: indwelling device UTI 1.6, RTI 0.8, Skin infection 0.8	[80]
USA 2010	2007	1	133	10,939	5.3	Modified CDC criteria, Risk factor: indwelling device UTI 1.6, Skin infection 1.0, RTI 0.6	[81]
France 2011	2006, 2007	5	578	44, 869	11.2 (range 8.4-13.3)	McGeer criteria, Risk factor analysis RTI 4.7, UTI 2.6, Skin infection 1.1	[82]
Netherlands 2011	2007, 2008 2009	3	15-24	1,275-1,772	6.7-7.6	Modified CDC criteria UTI 3.8, LRTI 1.6, URTI 0.9, Conjunctivitis 0.6	[75]
Ireland 2012	2010	1	69	4,170	11.3	Part of HALT, Risk factor analysis UTI 40%, RTI 28%, Skin infection 20%	[83]
Scotland 2010	2010	1	83	4,870	2.6	Part of HALT, Risk factor analysis UTI 53%, RTI 19%, skin infection 16%	[84]
Netherlands 2012	2010	1	10	1,429	2.8	HALT methodology, Risk factor analysis UTI 0.7	[85]
Germany 2012	2011	1	40	3,732	4.3	HALT methodology, Risk factor analysis UTI 1.2, Skin infection 1.2, RTI 1.1	[86]

Italy 2012	2003-2006	6	11	1,586	11.5	McGeer criteria, Seasonal variation RTI 5.7, UTI 2.9, Skin infection 1.6	[87]

UTI, urinary tract infection; RTI, respiratory tract infection; URTI, upper respiratory tract infection; LRTI, lower respiratory tract infection; SSI, surgical site infection

HALT, Healthcare-Associated infections in Long-Term care facilities project; CDC, Center for Disease Control and Prevention

2.6.3 Incidence studies of healthcare-associated infections

Incidence studies of HAIs have been published in five countries: Germany, Italy, Norway, Sweden and the USA. Most of them were from the USA. The largest study with 472,019 resident-days was from the USA. The incidence density varied between 3.8 and 11.8 infections/1000 resident-days (Table 3). The UTI rate was 0.6-3.2/1000 resident-days, RTI 1.2-2.7, and skin infections 0.5-2.5.In US acute-care hospitals the HAI incidence was 9.3/1000 patient-days [96].

Table 3. Incidence studies on healthcare-associated infections in long-term care facilities

Country Publication year	Time period	Number of facilities	Number of resident-days surveyed	Incidence density (infections per 1000 resident-days)	Definitions /Remarks	Reference
USA 1999	Jan 1996 to June 1998	6	328,065	3.8	McGeer criteria UTI 1.5, RTI 1.2, Skin infection 0.9	[74]
USA 1999	1996-1998	4	560 residents	1.4-4.1	McGeer criteria UTI 0.1-2.0, RTI 0.2-2.1	[89]
Germany 2005	Dec 1998 to Nov 1999	1	34,793	6.0	Modified McGeer criteria, Risk factor analysis RTI 2.2, Skin infection 1.2, GI infection 1.2, UTI 1.0	[47]
USA 2005	July 2001 to June 2002	17	472 ,019	3.6	McGeer criteria RTI 1.75, Skin infection 1.1, UTI 0.6	[90]
Italy 2006	May to Nov 2003	4	21,503	11.8	McGeer criteria, Risk factor analysis UTI 3.2, RTI 2.7, Skin infection 2.5	[91]
USA 2005	2003, 12 months	11	37-320 residents	5.0-10.8	CDC criteria Data on facility level	[92]
Sweden 2008	2003, 3 months	58	3,002 residents	3.3	Physicians' diagnoses	[93]
Norway 2007	Oct 2004 to March 2005	6	142,688	5.2	McGeer criteria, Risk factor analysis UTI 2.0, LRTI 1.4, Conjunctivitis 0.8, Skin infection 0.5	[94]
Germany 2011	Oct 2008 to Aug 2009	7	74,626	5.3	McGeer criteria GI 1.6, RTI 1.2, UTI 1.0 7 epidemic clusters : 3 RTI, 3 GI and 1 Conjunctivitis	[95]

UTI, urinary tract infection; RTI, respiratory tract infection; LRTI, lower respiratory tract infection; GI, gastrointestinal

CDC, Center for Disease Control and Prevention

2.6.4 Antimicrobial use

Prevalence surveys of antimicrobial use in LTCFs have been published in 11 countries [11,12, 75,78,79,83-86,97-100]. The first studies were from Norway [11]. The largest survey is the ESAC survey, with 10,388 residents [12]. The prevalence of antimicrobial prescription in USA and Europe varied between 2.4% and 15.0% (Table 4). UTI and RTI were the most common indications for prescription.

Table 4. Prevalence surveys on antimicrobial use in long-term care facilities

Country Publication year	Year	Number of surveys	Number of facilities	Number of residents	Prevalence (%)	Remarks	Reference
Norway 2000	1997, 1998, 1999	3	65-70	4,400-5,000	6.8	Range 6.6-7.1	[11]
Italy 2007	2001	1	49	1926	6.3	22% unclear reason for antimicrobial use	[78]
Norway 2004	2002, 2003	4	203-323	11,465-17,174	5.5-5.9		[79]
Norway 2010	2006	1	44	1,473	15	10 % prophylaxis and 6 % treatment UTI treatment 66%, RTI treatment 20%	[97]
Netherlands 2011	2007, 2008, 2009	3	15-24	1,275-1,772	6.6	Range 5.5-7.3	[75]
Canada 2011	2009	1	363	37,371	5.9	44% claim for a physician bedside visit 17% diagnostic code for infectious disease	[98]
USA 1991	Not known	1	52	3,899	8		[99]
15 European countries 2011	2009	2	85	10,388-9,430	6.5 and 5.5	ESAC methodology	[12]
Northern Ireland 2011	2009	2	30	970-984	13.2 and 10.7	ESAC methodology UTI prophylaxis 38% and 47% UTI treatment 20% and 17%	[100]

Ireland 2012	2010	1	69	4,170	10.2	HALT methodology 5.9 antimicrobial treatment: RTI 35%, UTI 32%, Skin infection 22% 4.3 prophylactic antimicrobials: UTI prophylaxis 89%	[83]
Scotland 2010	2010	1	83	4,870	7.3	HALT methodology	[84]
Netherlands 2012	2010	1	10	1,429	3.5	HALT methodology	[85]
Germany 2012	2011	1	40	3,732	2.4	HALT methodology	[86]

ESAC, European Surveillance of Antimicrobial Consumption, HALT, Healthcare-Associated infections in Long-Term care facilities project, UTI, urinary tract infection, RTI, respiratory tract infection

Incidence studies on antimicrobial use were performed in Canada, Norway, Sweden and the USA [9.89,92,99,101-105]. In these incidence studies, the use of antimicrobials varied between 1.9 and 14.9/1000 resident-days. Some studies used daily defined doses (DDD)/1000 resident-days. This figure varied between 33 and 148 DDD/1000 resident-days (Table 5).

Table 5. Incidence studies on antimicrobial use in LTCFs

Country Publication year	Year Time period	Number of facilities	Number of resident-days surveyed	Incidence density (antimicrobial courses per 1000 resident-days)	Remarks	Reference
USA 1990	1985, every 4th month during one year	2	18,000	12.1	17% prophylactic use UTI treatment 33%, RTI treatment 29%, Skin infection treatment 11% 54% prescriptions via telephone	[9]
USA 1991	12 months follow-up	52	3,899 residents	4.6	54% at least one antibiotic course UTI 36%, Skin infection 14%, RTI 17% 44% documentation on physicians' examination 94% prescribed by physicians	[99]
USA 1999	1996-1998	4	560 residents	4.0-7.2		[89]
USA, Canada 2003	1998-1999 12 months	50	9,156	1.9-14.9	21% received no antibiotics. 44 DDD/1000 resident-days in USA and 33 DDD/1000 resident-days in Canada	[101]
USA 2008	Sept 1 2001 to	73	4,780	4.8	42% received at least one antibiotic	[102]

	Feb 28 2002				RTI 33%, UTI 32% 13% no documentation of infection Risk factor analysis (Minimum Data Set, MDS)	
USA 2005	2003 12 months	11	37-320 Data facility level	8.0-14.8	Levofloxacin most commonly used antimicrobial	[92]
Sweden 2008	Sept to Dec 2003 3 months	58	3,002 residents	2.8	889 infections/3002 residents: UTI 55%, Skin infection 17%, RTI 15% 84% (769/889) treated with antibiotics 38% prescription issued by phone, fax or e-mail.	[103]
Norway 2007	2003 12 months	133		148 DDD/1000 bed-days (range, 43-444)	Methenamine used by 95% of nursing homes (46% of all DDD) Excluding methenamine: 79 DDD/1000 bed-days (range, 19-164)	[104]
Norway 2012	March 2007 to Feb 2008	10	360	55 DDD/1000 bed-days	UTI 53%, RTI 21%, Skin infection 14% Prescriber information, compliance with guidelines	[105]

DDD, daily defined doses; UTI, urinary tract infection; RTI, respiratory tract infection

In Finnish acute-care hospital data the prevalence of antimicrobial prescription was 39% [88]. In Finland primary healthcare center wards antimicrobials were prescribed 52-529 DDD/1000 patient days [106]. In USA acute-care hospitals, antimicrobials were prescribed for 63.7% of the patients, equivalent to 839 DDD/1000 patient-days [107].

2.6.5 Risk factors for healthcare-associated infections

Urinary catheter, vascular catheter, and any type of wound have been identified as risk factors for HAIs in LTCFs in prevalence surveys [47, 80-83, 85, 86, 94]. A case-control study in Norway showed that 16% of the residents with HAIs died in NHs, compared with 2.4% in the control group during 30 days of follow-up [108].

2.7 Interventions in antimicrobial prescription

There are five published intervention studies on antimicrobial use in LTCFs [109-113], three from the USA [109,112,113] and one each from Canada [111] and Sweden [110] (Table 6). Two were randomized controlled trials [110,111] and three before-after surveys [109,112,113]. Schwartz and colleagues in the USA managed with teaching and guidelines to reduce antimicrobial days and initiation [113]. Zabarsky et al. in the USA reported a successful educational intervention to reduce inappropriate treatment for asymptomatic bacteriuria [112]. Monette and colleagues in Canada trained physicians with an antibiotic guide and managed to reduce nonadherent antibiotic prescriptions in the intervention group [111]. Pettersson and colleagues in Sweden used focus groups, educational materials, and guidelines. The proportion of infections handled by physicians as wait and see increased significantly in the intervention group. The proportion of quinolones used decreased in both groups [110]. Jump and colleagues in the USA observed a decrease of 30% in total antimicrobial use after the initiation of an infectious disease consultation service in the LTCF [109].

Table 6. Intervention studies on antimicrobial use in long-term care facilities

Country Publication year	Year Time period	Type of study/intervention	Number of facilities	Number of residents	Results	Reference
USA 2012	Jul 2009 to Dec 2010	ID consultation service	1	240	Total antimicrobial use decreased 30%, fluoroquinolone use decreased 38%, oral vancomycin use increased 89%, metronodazole use decreased	[109]
Sweden 2011	Oct 2004 to Jan 2005	Clustered randomized controlled study Focus groups, education, materials, guidelines	58, 18 on both arms Final analysis 26 intervention and 20 control	1394 intervention and 1143 control Final analysis: 1394 intervention and 1143 control	Proportion of quinolones decreased in both groups Proportion of infections treated with antibiotics decreased Proportion of infections handled by physicians as wait and see increased significantly in intervention group	[110]
Canada 2007	Dec 2001 to Feb 2003	Prospective, pair-matched, clustered randomized controlled trial Antibiotic guide to physicians	10, 8 in final analysis	36 physicians	Proportion of non-adherent antibiotic prescriptions in intervention group decreased 38%, 28% and 23%. In control group it increased to 53%	[111]
USA 2008	Feb 2002 to Oct 2004	Educational information on UTI diagnosis and treatment	1	190	Inappropriate submission of urine cultures decreased 2.6 to 0.9/1000 patient-days ($p<0.01$) Treatment of asymptomatic bacteriuria reduced from 1.7 to 0.6 per 1000 patient-days ($p<0.01$) Total antimicrobial days of therapy reduced from 167.7 to 117.4 per 1000 patient-days ($p<0.001$) Reductions maintained for 30 months.	[112]
USA 2007	Jan 2000 to	Teaching, guidelines	1	340	Monthly antimicrobial days fell 30%, antimicrobial	[113]

	May 2004	starts fell 26%. Decreases sustained 2 years after invention

ID infectious disease, UTI, urinary tract infection

2.8 Prevention of healthcare-associated infections

2.8.1 Hand hygiene

Ignaz Semmelweis found 150 years ago the importance of hand hygiene in infection control. Hand hygiene remains the most important means of preventing infections and transmission of multi-drug resistant bacteria [7]. Since 2005, the World Health Organization (WHO) has promoted hand hygiene through a patient safety program. In 2012, the WHO published Hand Hygiene in Outpatients and Home-based care and in LTCFs guidebook [114]. Many countries in Europe have implemented national hand hygiene campaigns [115, 116]. In Norway, LTCFs were also one of the target groups in the campaign [117].

Reference data on hand rub consumption per patient-days in LTCFs are scarce. Easy access to alcohol-based hand rubs improved hand hygiene compliance [118]. A study in Canada reported that only in 20% of LTCFs were alcohol-based hand rubs placed at the point of care, in 34% in hallways, and in 79% in other areas [119].

2.8.2 Compliance studies on hand hygiene

In observational surveys from LTCFs, hand hygiene compliance of staff has been low, 14.7% in Italy [120] and 17.5% in the USA [121]. In France, Eveillard and colleagues reported a surprisingly high hand hygiene compliance of 59.5% [122] and 61.5% [123]. They had had a hand hygiene training project one year before the study. They thought that might have influenced to the hand hygiene compliance.

2.8.3 Intervention studies on hand hygiene

In Norway during the National Hand Hygiene Campaign, the consumption of alcohol-based hand rubs in LTCFs increased from 2.4 L to 11 L/1000 resident-days (Table 7). Only 27% of the NHs participated in the campaign [117]. In a before-after intervention survey from Taiwan, hand hygiene compliance increased from 9.3% to 30.4%. The incidence density of infections decreased from 2.0-1.7/1000 resident-days to 1.5 [124].

Table 7. Intervention studies on hand hygiene

Country Publication year	Year Time period	Type of study/intervention	Number of facilities	Number of residents	Result	Refer-ence
Norway 2011	2005	Pre- and post-surveys, National hand hygiene campaign: focus groups, hand hygiene package,	45	N/A	Hand rub use increased from 2.4 L/1000resident days to 15.4 L/1000 resident days 30/45 updated their hand hygiene guidelines	[117]
Taiwan 2008	2005 3 months	Before - after evaluation Hand hygiene training program for nurse assistants,	3	40 nurse assistants	3 months after the training nurse assistants had significantly more knowledge and hand hygiene compliance increased from 9.3% to 30.4% (p<0.001) The infection rate among the residents after the program was significantly lower than just before .	[124]
Hong Kong 2011	2007 2 weeks interventi on	Cluster randomized controlled trial, pocket-sized containers of hand rub, remainders, education	3 intervention and 3 control	675	In intervention group adherence to hand rub increased from 1.5% to 15.9% (p=001), in control group there was no change. Incidence of serious infections decreased in intervention LTCFs.	[125]
USA 2000	N/A one year	4 sets of matched pairs intervention sites had 3 part educational program	8	890	In intervention sites infection incidence density rate decreased from 6.3 to 4.2/1000 resident-days, in control sites decreased slightly from 3.4 to 3.2/1000 resident days	[126]
USA 2013	2010	Before-after survey, hand hygiene education, posters, videos, pocket-sized containers of hand rub, touch free dispensers of hand rub	1	174	Infection rates for LRTI reduced from 0.97 to 0.53/1000 resident-days (p=0.01). Hand hygiene compliance was 54%.	[127]

Hong Kong 2012	2009-10	Cluster randomized controlled trial, WHO multimodal strategy	12 intervention and 6 control	1696 intervention 711 control	Hand hygiene compliance increased from 24% to 60% In control group compliance was 20% before and after.	(128)

LTCF long-term care facility, LRTI lower respiratory tract infection, WHO World Health Organization

In a randomized controlled intervention study from Hong Kong comprising LCTFs that used pocket-sized containers of alcohol-based hand rub, together with education and posters, the adherence to hand hygiene increased from 26% to 33%. The incidence density of serious infections decreased from 1.42/1000 resident-days to 0.65 [125].

In the randomized controlled intervention survey in eight LTCFs from the USA, the incidence density of infections decreased in the intervention group from 6.3 to 4.2 and in the control group from 3.4 to 3.2. The reduction was greatest in RTIs. They reported no data on alcohol-based hand rub consumption or compliance [126].

Another before-after intervention study was conducted in the USA during the H1N1 pandemic flu season. Hand rub dispensers were placed in high-traffic areas. Hand hygiene training was given to all personnel. During the intervention period, hand hygiene compliance was 54%. LRTIs were reduced from 0.97/1000 resident-days to 0.53 [127]. In Hong Kong, the WHO multimodal strategy to improve hand hygiene in LTCFs was implemented in controlled randomized intervention. Hand hygiene compliance increased from 27-22% to 61-49% [128].

2.8.4 Influenza vaccination

Influenza-related excess mortality increases exponentially after the age of 65 years [129]. People at least 80 years of age have at about 11 times higher risk of dying than those 65-69 years of age [129]. The influenza vaccine study in the Netherlands by Govaert and colleagues suggested that vaccine efficacy declines with age [130]. There are few trials including older people, and the evidence for influenza vaccine protection in adults 65 years of age or older is lacking [129, 131]. Observational studies between 1980 and 2001 estimated the effect of seasonal influenza vaccine on rates of hospital admissions and mortality in individuals 65 years of age and older. Reduction in all-cause mortality after vaccination in these studies ranged from 27% to 75%, which may have been overestimates [129,131,132,133]. Recent studies showed that influenza vaccination decreased all-cause mortality in people 65 years of age or older by 4.6% and hospital admissions for pneumonia and influenza by 8.5% [132]. Vaccines are the best intervention available for seasonal influenza. Healthcare workers vaccination has a likely protected effect for residents in LTC against influenza [134, 135]. Thomas and colleagues in Cochrane Review did not found evidence that vaccinating healthcare workers prevents influenza in residents in LTCFs [136]. Better studies are needed to strengthen the evidence. Because influenza vaccination is widely recommended for older people, placebo controlled randomized controlled trial would no longer pass ethical review.

2.8.5 Pneumococcal vaccination

The 23-valent polysaccharide pneumococcal vaccine (PPV) is 40-70% efficacious in the prevention of invasive pneumococcal disease (IPD) in older persons [137]. In Stockholm, Sweden PPV was offered to all in habitants >65 years of age in 1999, 2000 and 2001. The incidence of invasive pneumococcal disease declined significantly during the study period (1997-2001) in the older persons but not in any other age group [137]. Moberley and colleagues in Cochrane Review found supporting evidence for recommendation of PPV to prevent IPD in adults. The evidence was less clear with adults in chronic illness [138]. From pneumococcal conjugate vaccine more data is needed before recommendations can be made for residents in LTCFs

2.9 Infection control in long-term care facilities

In all, 26/33 countries (Table 8) participated in the improving Patient Safety in Europe (IPSE) survey [139]. The results showed that 8/33 countries in Europe have national laws on infection control in LTCFs. Four countries have included infection control among national criteria for the authorization of LTC services, and seven among the national criteria for accreditation. In 13 countries, national recommendations or guidelines on infection control are available and in four countries are under preparation.

Table 8. Countires answering to the IPSE survey [139]

Austria	Lithuania
Belgium	Luxemburg
Bulgaria	The Netherlands
Croatia	Norway
The Czech Republic	Portugal
Denmark	Republic of Ireland
Estonia	Slovakia
Finland	Spain
France	Sweden
Germany	Turkey
Hungary	UK-England
Italy	UK-Scotland
Latvia	UK-Wales

IPSE Improving Patient Safety in Europe

By definition, infection control programs in LTC are carried out by the Ministry of Health in three countries, by a public agency in two countries, by the Ministry of Health plus a public agency in three countries, by the Ministry of Health plus a public agency plus professional agencies in four countries, and by a public agency plus a professional organization in one country.

Infection control in LTCFs is organized differently in various countries (Table 9). In 16 countries at least one recommendation has been issued for IC in LTCFs (Table 10). Five countries reported studies during January 2001 - December 2005 at national, regional, or local level, aimed at measuring the frequency of infections in LTCFs. Five countries issued recommendations for surveillance of infections in LTCFs. Five countries set up a surveillance system for infections in LTCFs. Twelve countries have issued at least one recommendation for antibiotic and antimicrobial resistance control in LTCFs [139].

Table 9. Organization of infection control activities in LTCFs IPSE survey [139]

	Number of countries
Legally responsible person for infection control in these settings	12
Infection control nurse within the service	5
Dedicated (only infection control actvities)	1
Partially detached (IC activities beside others)	4
Consultancy by hospital IC nurse	8
IC Committee responsible for policies in this setting	6
Educational program for LTCF personnel	5

LTCF long-term care facility, IPSE Improving Patient Safety in Europe, IC infection control

Table 10. Recommendations for infection control in long-term care facilities in European countries responding to IPSE survey [139]

General recommendations	11
UTI	9
Pneumonia	8
Influenza	10
Tuberculosis	8
Skin infections	8
Gastrointestinal infections	9
Conjunctivitis	5
Clostridium difficile	8
Scabies	8
Outbreak control	11
Isolation	13
Hand washing/hand hygiene	14
Immunization of the residents	12
Disinfection/sterilization	11

IPSE Improving patient safety in Europe

2.10 Organization of infection control in long-term care facilities in Finland

In Finland, according to the Communicable Disease Law, revised in 2004, all healthcare settings should have HAI prevention and control programs. Infection control teams at the district level play a consulting role in these activities. In practice, not all healthcare settings have sufficient in-house expertise in infection control. This is especially true for new settings such as sheltered housing and dementia units. Surveys on infection control resources in Finnish acute-care hospitals were conducted in 2001 and 2009 (data from 2000 and 2008) [140]. However, resources for infection control in LTCFs have not been surveyed in Finland.

2.11 Guidelines

The Society for Healthcare Epidemiology of America (SHEA) and Association for Professionals in Infection Control and Epidemiology (APIC) have published a guideline: Infection prevention and control in the long-term care facility [48]. The guideline reviews the literature on infections and infection control programs in LTCFs.

Finnish infection control guidelines for MRSA [141], UTI [142], *Clostridium difficile* [143], norovirus [144], and scabies [145] have sections specifically for LTCFs. The Finnish Society for Hospital Infection Control provides training material, a digital video disk (DVD) on good hygiene practices in healthcare, and an E-learning course in infection control [146]. They are basically made for acute care, but can also be used in LTCFs.

2.12 Previous studies in Finnish long-term care facilities

There are few publications on HAI in Finnish LTCFs. Kotilainen and colleagues described an MRSA outbreak and eradication of MRSA from a healthcare center ward and NH in 1993 [147]. An epidemic MRSA strain was isolated from eight LTCF residents at a healthcare center hospital, from four residents in an NH, and one member of the staff. The NH was in the same building as the healthcare center. Two residents received topical mupirocin treatment only, and nine residents who were throat carriers received both topical and systemic treatment. One resident remained an MRSA carrier and was contact isolated in the healthcare center until his death.

Kotilainen and colleagues reported two MRSA outbreaks from August 1991 to October 1992 [148]. During these outbreaks, 202 MRSA carriers were found. To stop the epidemic, aggressive measures were conducted: continuous staff education, contact isolation for MRSA carriers, screening for persons exposed to MRSA, cohort nursing of MRSA carriers and MRSA-exposed patients/residents. They were able to eradicate the MRSA strains with these methods [148].

Kerttula and colleagues studied the molecular epidemiology of an MRSA outbreak in a healthcare center ward and associated NH in 2003 in northern Finland [149]. They identified five MRSA strains, of which two had an outbreak genotype not seen previously. Six meticillin-sensitive *Staphylococcus aureus* strains were genotypically related to the epidemic strains.

Kerttula and colleagues studied *Staphylococcus aureus* colonization in NH residents in the Helsinki area in 2004 and found MRSA prevalence of 0.9% [150].

Kerttula and colleagues reported in 2004 an increase in MRSA cases, especially in elderly persons, during1997-2002 in the National Infectious Diseases Register. MRSA was found in LTCFs in 14/20 healthcare districts [61].

In 2006, Puhto and colleagues conducted a PPS in all healthcare center hospitals (44) in the Oulu University Hospital District [106]. The prevalence of HAI was 10.1%. UTI (30%) was the most common infection, followed by LRTI (27%), and skin infections (20%). The main risk factors for HAI were: more than three antibiotic prescriptions during the previous year, fully bedridden, renal disease, venous catheter, age over 80 years, previous hospitalization during the past 6 months, and implanted foreign material. Some 18% of the patients received antimicrobial treatment and prophylaxis [106].

2.13 National Supervisory Authority for Welfare (VALVIRA) and Health and Regional State Administrative Agencies (Aluehallintovirasto)

Finland's national supervising authority on social welfare and healthcare cooperates with six regional administrative agencies that have primary responsibility for supervising social care in their own region. All six agencies have similar duties in fields such as healthcare and social welfare, but they differ in actual geographical scope of jurisdiction [151].

Regional State Administrative Agencies give licenses to private LTCFs. They guide service providers in undertaking effective supervision. This service includes guidelines on prevention and surveillance of HAIs. LTCFs provide annual reports to the Regional State Administrative Agency. Audits are made in a minimum of 6% of private LTCFs yearly. The audit identifies risks and shortcomings in the facility and targets supervisory activities, according to the law on private social services [152].

2.14 Resident Assessment Instrument

The Resident Assessment Instrument for LTCF version 2.0 (RAI-LTCF) benchmarking system is designed to collect the minimum amount of data needed to guide care planning and monitor residents in LTC settings [153]. It has been used in Finland since 2000. The data have been used as quality-of-care indicators to improve an individual's quality of life in LTCFs. In 2009, 95 facilities in Finland (62 NHs and 35 healthcare centers had RAI-LTCF equipment in use in their facilities [15]. In addition to detailed characteristics of facilities and their residents, MDS-LTCF version 2.0 data collection includes information on infections and medications, including antimicrobials [153].

3 Aims of the Study

The principal aim of the present study was to determine antimicrobial use and prevalence of infections in LTCFs in Finland and evaluate the feasibility of various methods to assess antimicrobial use and prevalence of infections in LTCFs.

The specific objectives were:

1. To determine the use of antimicrobials and occurrence of multi-drug resistant bacteria in LTCFs in the Central Finland Healthcare District (I).

2. To reduce the inappropriate use of antimicrobials to prevent UTIs in LTCFs in Central Finland Healthcare District (II).

3. To promote the use of alcohol-based hand rubs in LTCFs in Central Finland Healthcare District (III).

4. To analyze the Finnish ESAC PPS data for evaluating the variability in prevalence of antimicrobial prescription among NHs and its relationship to resident characteristics (IV).

5. To analyze the MDS-LTCF version 2.0 data on antimicrobials and infections collected in Finnish LTCFs in September 2011 and compare the results with those detected by previous surveys performed in Finland (V).

4 Materials and Methods

4.1 Long-term care in Finland

In Finland, the LTC system is unique in nature. The healthcare center hospitals care for both acute and chronic patients about equally. The frailest bedridden patients are often cared for in such units. The NHs are responsible for caring of patients who can still somehow walk, independently or assisted. An increasing number of sheltered housing are making their appearance. In these units, patients may be even frailer than in NHs, but the financial streams make it less expensive for the local municipalities, because the state pays a larger part of the expenses. Most patients in LTCFs suffer from memory loss or dementia. Thus special dementia units have also been started up during recent decades, especially to care for patients with neuropsychiatric symptoms.

4.2 Study I-III

Central Finland Healthcare District consists of 23 local municipalities with a population of some 269,000, 5% of that in the entire country. The LTC is also here divided into several setting types, as described above. Local general practitioners are responsible for the medical care in these settings. The central hospital in Jyväskylä is responsible for special care, and it has an infectious disease consultant, several infection control nurses, as well as a small geriatric unit, from where regular visits to local LTCFs have been made during the last 20 years.

From September 27, 2004 through October 3, 2005, a team comprising an infectious disease consultant (MR), an infection control nurse (AJ) and a geriatrician (PK) visited all the facilities providing LTC for elderly persons in Central Finland Healthcare District. A total of 26 healthcare center hospital wards, 29 NHs, 10 dementia units, and 58 sheltered care units were visited, both public and private institutions. Their total numbers of patients were 1125, 1080, 141, and 1206, respectively. Thus, the study included a total of 3,552 patients. The visits required 33 days. In each unit, head nurses and often also general practitioners responded structured questions orally. The questionnaire [Appendix 1] covered information on patient population, antimicrobials prescribed for different indications, criteria for obtaining urine samples, and diagnostic tests. The answers were recorded on the forms by the team. Suggestions were made to correct negative practices whenever found. A free discussion was allowed and even encouraged towards the objectives of the intervention. After the interview the team, together with representatives of the local nursing personnel evaluated the facility environment (contents of the medicine cabinet, placements of the hand disinfection bags, patient rooms, toilets, and saunas). During this round, many items were discussed and recommendations given when needed. New locations for additional hand rub containers were proposed. The head nurses were requested to review beforehand patients' records for all ongoing systemic antimicrobials

and their indications at 8:00 am on the day of the visit, and monthly use of alcohol-based hand rubs in liters. After these visits and review of the KESLAB microbiology data on urine cultures, the regional guidelines for prudent use of antimicrobials in LTCFs were published [Appendix 2].

Annually after the last site visit, on October 3, 2006, 2007, and 2008, the head nurse of each unit responded to a postal questionnaire [Appendix 1] that requested information on patients and ongoing systemic antimicrobials and their indications at 8:00 am that day, the amount of alcohol-based hand rubs in liters used during the preceding month, MRSA and ESBL carriers and patients with urinary catheters. Every year the results of the postal survey were sent to the units. In the analysis we utilized only those units that were visited in 2005, and answered the three annual (2006, 2007, 2008) questionnaires. The numbers of the patients in each setting were rather comparable. During the follow-up, one unit ceased operations, one had totally changed its role to care for much younger, mentally handicapped individuals, and one new larger sheltered housing unit was started up; these units were all excluded from the analyses. Questionnaires are available in the Appendix 1.

4.3 Study IV

ESAC was a European project coordinated by the University of Antwerp, Belgium. There were 34 countries participating in ESAC, among which were all the 27 EU member states. Each country had a national network of experts. They collected data on the use of antibiotics, and sent the data to the University of Antwerp. ESAC is funded by the ECDC, which is located in Stockholm, Sweden. Several European studies coordinated by the ESAC team have investigated antimicrobial use in hospitals and primary care. Studies have not investigated the level of antimicrobial prescription in NHs on a European scale. The aim of ESAC NH point prevalence studies (PPSs) was to determine the level of antimicrobial prescription in European NHs during April (pilot) and November 2009.

In 2008, the ECDC funded the HALT (Healthcare Associated infections in Long-Term care facilities) project. The project was based on the results of two former European projects: ‘Improving Patient Safety in Europe` (IPSE) and the ESAC-3 NH subproject. The HALT pilot study was conducted in November 2009 together with the ESAC-NH PPS. The HALT PPS was conducted between May and September 2010.

Eight NHs from 3/20 healthcare districts in Finland volunteered to participate in three PPSs, which were performed on single days in April and November 2009, and nine NHs from four healthcare districts in May-September 2010. In April 2009, 1,706 residents (range by NH, 60-602), in November 2009, 1,665 residents (range by NH, 60-549), and during May-September 2010, 2320 residents (range by NH, 60-688) were included in the surveys.

All participating NHs were public institutions. The data were collected in April and November 2009 by internal and external surveyors with paper-based forms using optical character reading, which were sent to the ESAC coordinating center for data entry. In May-September 2010 the data were entered via web-based PPS software developed by the ESAC by the national coordinating team.

Every participating NH completed an institutional questionnaire with questions on general NH characteristics, denominator data with certain characteristics (e.g. number of residents with wounds or impaired mobility) of all eligible residents (i.e. present at 8:00 am for at least 24 hours), questions on medical care and coordination, infection control practices, and on antibiotic consumption. In addition, a questionnaire on resident characteristics (e.g. gender, age, urinary catheter, wound, incontinence) and characteristics of the antimicrobial treatment (e.g. drug, indication, administration route) had to be completed for each resident, using antibiotics on the day of the PPS. The antimicrobial treatments were classified according to the Anatomical Therapeutic Chemical (ATC) classification system. Questionnaires are available in the Appendix 3.

4.4 Study V

The Resident Assessment Instrument for LTCFs with a questionnaire known as the Minimum Data Set version 2.0 for LTCFs (MDS-LTCF version 2.0) has been used for evaluating the needs, strengths, and preferences of residents in LTCFs since 1988 in several countries in North America, Australia, Europe, and Asia. In the USA and Canada RAI-LTCF is mandatory [153]. In Finland, the RAI-LTCF has been used since 2000 [15, 153]. Beside detailed characteristics of facilities and their residents, MDS-LTCF data collection includes information on infections and medications, including antibiotics [153]. The use of the RAI-LTC instrument in Finland is voluntary, but once an organization joins the quality development network, regular assessment of all residents is expected. The reliability of the RAI-LTC instrument in NH care has been estimated in general [15,154-156], as well as more specifically for cognitive impairment [157] and acute confusion [158].The categories of urinary catheter, urinary incontinence, diarrhea, skin ulcers, being bedridden, and having had a hospital stay are standard quality indicators in the RAI-LTC instrument [156].The use of antimicrobials is based on a list of all medications (Section U), identifying each medication the resident has received within 7 days prior to the assessment. The information on infection diagnoses is based on a checklist of infections (Section I2), requiring the assessor to check which infections (in the list) are relevant for the current care of the resident. Antimicrobial use is therefore, in this dataset, not directly linked with the infection that it is intended to treat or prevent.

In September 2011, 253 facilities from 16/20 healthcare districts in Finland used the RAI. We studied 652 reporting units (115 were healthcare center wards, 263 NHs, and 274 sheltered care units). There were a total of 12,784 residents, all in long-term care. An overview of the study population and methods appears in Table 11.

Table 11. Overview of the study population

Study	Time period	Number of units	Number of residents	Number of healthcare districts	Study methods
I	2004–2005	123	3,552	1	Visit, postal questionnaire
II	2004–2008	64	2,321	1	Visit, 3 annual postal questionnaires
III	2004–2008	119	3,455	1	Visit, 3 annual postal questionnaires
IV	2009–2010	9	5,791	4	3 point prevalence surveys*
V	2011	652	12,784	16	Prevalence survey**

*European Surveillance of Antimicrobial Consumption (ESAC) nursing home subgroup project

**Resident assessment instrument (RAI) minimum data set

4.5 Statistical analysis

In all studies the most important outcomes are expressed with 95% confidence intervals (CIs). In study I the use of hand rub was skewed, and the CIs for the mean differences were obtained by bias-corrected bootstrapping (5000 replications). The differences in proportions were analyzed by χ^2 test. A Poisson regression model was used to estimate the incidence rate ratio (IRR). In study II the data are presented as counts with percentages. Generalized linear models for binomial family (logit link) were used to analyze the longitudinal data. In study III the data are presented as means with standard deviations (SDs) or as counts with percentages. Bootstrap-type regression analyses or logistic regression analysis clustered by the type of setting were used to analyze the longitudinal data. In study IV the prevalence of antibiotic prescription with 95% CIs in each NH during the three PPSs was calculated. The heterogeneity of resident characteristics and antibiotics prescription among the NHs was evaluated by median odds ratio (OR). Since the resident level data on characteristics was not available (only antibiotic prescription), the resident mix and antibiotic prescription among the NHs were evaluated by the heterogeneity, measured by median odds ratio (OR). Univariate and multivariate mixed-effect logistic regression models adjusted for time were conducted to identify the risk factors for antimicrobial prescription [159-161]. In study V the χ^2 test was used to assess statistical significance for categorical variables. $P < 0.05$ was considered statistically significant.

The analyses were performed, using Stata 11.1 (StataCorp, College Station, TX, USA) and SAS 9.2 software (SAS Institute Inc., Cary, NC, USA).

4.6 Ethical aspects

The study protocol was approved by the Ethics Committee of Central Finland Healthcare District (I-III) and by the local ethics committees of each healthcare district (IV).

5 Results

5.1 Characteristics of long-term-care facilities and their residents

In Central Finland Healthcare District, a total of 123 units were visited during 2004-2005; 47% of these were sheltered care units. In healthcare center hospitals, approximately half of the patients were LTC residents; in other settings, this figure was 90% or more. Over 90% of the patients were ≥ 65 years of age and 69% were female. Physical functioning was best among patients in sheltered care, in which 50% of the patients managed independent toileting.

Table 12 compares the characteristics of patients in healthcare center wards and sheltered care units during the site visits in 2004-2005 (Study I), RAI LTCFs in 2011 (Study V), and Table 13 residents in NHs in 2004-2011 (Studies I, IV, V). In all types of settings, dementia was more common in 2011 than during 2004-2005 (healthcare center wards, 73% vs. 39%; sheltered care units, 73% vs. 43%; NHs, 79% vs. 60%). In sheltered care units, the proportion of bedridden patients increased from 1% during 2004-2005 to 9% in 2011. Skin ulcers and the use of urinary catheters increased in all types of settings. The proportion of bedridden residents in NHs taking part in the ESAC/HALT surveys was similar to that in the healthcare center wards (43-52% vs. 38-41%). In term of resident mix, the NHs differed most in the proportion of bedridden and wheelchair residents (Study IV). The proportions of incontinent and disoriented residents, and residents with wounds differed less, and were similar with the prevalence of antimicrobial prescription. It was smaller for incontinent and disoriented residents and residents with wounds, for which it was similar to the prevalence of antimicrobial prescription. In September 2011, the proportion of residents admitted to acute-care hospitals in the previous 90 days was larger in healthcare center hospital wards than in NHs and sheltered care (20% vs. 13-14%) ($p<0.01$)(Study V).

Table 12. Characteristics of patients in healthcare center wards and sheltered care units in Study I and V.

	Study I, 2004-2005		Study V, 2011	
	Healthcare center wards	**Sheltered care units**	**Healthcare center wards**	**Sheltered care units**
Number of wards/units	26	58	115	274
Numbers of residents	1,125	1,206	3,262	4,260
Age >85 years, %	NA	NA	46.0	47.0
Male residents, %	34.3	31.3	34.0	27.0
Urinary catheters, %	5.1	1.2	7.0	2.0
Urinary incontinence, %	NA	NA	7.0	57.0
Dementia, %	39.0	43.0	73.0	73.0
Bedridden, %	38.0	1.0	41.0	9.0
Skin ulcers (due to any cause), %	6.0	3.0	11.0	7.0

Table 13. Characteristics of residents in nursing homes in Studies I, IV and V

	Study I	Study IV			Study V
	2004-2005	April 2009	November 2009	May-August 2010	September 2011
Number of nursing homes	39	8	8	9	263
Number of residents	1,221	1,706	1,665	2,320	5,262
Residents over 85 years, %	NA	NA	46.5	49.7	49.0
Male residents, %	28.7	NA	25.8	25.4	27.2
Urinary catheters, %	2.0	2.2	3.1	3.0	4.0
Incontinent residents, %	NA	80.8	81.0	79.7	78.0
Dementia, %	59.8	67.6	69.6	68.0	79.0
Bedridden, %	22.3	43.2	52.0	48.1	25.0
Skin ulcers (due to any cause), %	2.5	7.3	10.2	9.5	9.0

5.2 Use of antimicrobials

Study I, II

In Central Finland Healthcare District, on the day of the baseline visit in 2004-5, the prevalence of on-going antimicrobials was 18.9% (672/3,552). The most common indication was the prevention of UTI (67.0%, 450/672), followed by acute UTI (14.9%, 100/672), RTI (7.7%, 52/672), skin infection (7.4%, 50/672), and other infections (3.0%, 20/672). On October 3, 2006, the prevalence was lower (15.5%, 540/3,489) and the indications as follows: 277 (51.3%) for UTI prophylaxis, 123 (22.8%) for UTI treatment, 55 (10.2%) for RTI treatment, 51 (9.4%) for skin infections and 34 (6.3%) for other infections. The prevalence remained on lower level until 2008, when the proportion of patients on antimicrobials was 15.4%. The use of antimicrobials for UTI prophylaxis decreased statistically significantly in all settings in 2006.

Study IV

In April 2009, 283 NH residents (16.6%; range by NH, 4.4-28.3%) received antimicrobials, and among these, 12 were given at least two antibiotics. In total, 295 antimicrobials were prescribed. In November 2009, 207 NH residents (12.4%; range by NH, 3.2-33.3%) received antimicrobials, among which 15 were given at least two antimicrobials. In total, 222 antimicrobials were prescribed. During May-September 2010, 226 residents (9.7%; range by NH, 4.4-21.7%) were given antimicrobials, of which 13 were given at least two antimicrobials. In total, 239 antimicrobials were prescribed. The prevalence of antimicrobial prescription varied among NHs from < 5% to > 30% and also within NHs during the three surveys. The prevalence decreased in the eight NHs that participated in all three surveys.

Over 95% of the antimicrobials were administered orally and most of them were prescribed for prophylaxis: 73.2% in April 2009, 54.5% in November 2009, and 62.8% during May-September 2010. The most common indications for antimicrobial prescription were UTI prophylaxis (460/756, 60.8%), UTI treatment (119/756, 15.7%), and RTI treatment (52/756, 6.9%). The prevalence of residents with UTI prophylaxis decreased from 12.0% to 6.1% during the study period.

Study V

In September 2011, 2013/12,784 (16%) residents used antimicrobials, of which 89 (1%) used at least two antimicrobials and two used three. The residents used antimicrobials in the healthcare center wards 576/3262 (18%), in NHs 708/5262 (13%) and in sheltered care 729/4260 (17%). Over 99% of all antimicrobials were used orally. Of all residents, 1310 (10%) received antimicrobials for prevention of UTIs: 319 (10%) in healthcare center hospital wards, 476 (9%) in NHs and 515 (12%) in sheltered care units. The use of antimicrobials (Studies I, II, IV and V) is summarized in Table 14.

The distribution of various antimicrobial agents prescribed by type of setting in the ESAC/HALT surveys during 2009-2010 (Study IV) and RAI LTCFs in 2011 (Study V) is shown in Table 15.

The antimicrobials most commonly prescribed were methenamine and trimethoprim. Pivmecillinam, cefalexin, and nitrofurantoin were the next most popular drugs. In healthcare center wards, fluoroquinolones were the third most popular on the list, in other facilities they were fifth or sixth.

Table 14. Use of antimicrobials in Studies I, II, IV and V.

	Study I		Study II		Study IV			Study V
	2004-2005	2006	2007	2008	April 2009	Nov 2009	May-Sept 2010	2011
Number of residents	3,552	3,489	2,253	2,197	1,706	1,665	2,320	12,784
Any antimicrobial, %	18.9	15.5	16.2	15.4	17.3	13.3	10.3	16.0
UTI prophylaxis, %	12.6	7.9	6.7	6.4	12.0	6.8	6.1	10.0
UTI treatment, %	2.8	3.5	4.0	3.8	2.1	2.9	1.5	NA
Methenamine, %	NA	NA	NA	NA	8.3	4.4	4.0	6.7
RTI treatment, %	1.5	1.6	NA	NA	1.0	1.0	0.9	NA
Skin infection treatment, %	1.4	1.5	NA	NA	NA	NA	NA	NA
Other infection treatments, %	0.6	1.0	NA	NA	NA	NA	NA	NA

UTI, urinary tract infection; RTI respiratory tract infection

Table 15. Antimicrobial prescriptions by type of setting in Studies IV and V.

	Study IV, 2009-2010	Study V, 2011			
	Nursing homes	Healthcare center wards	Nursing homes	Sheltered care units	All
All prescriptions, n	756	606	741	759	2,106
Methenamine, %	41	36	44	44	42
Trimethoprim, %	14	18	21	31	24
Cephalexin, %	8	9	8	6	7
Pivmesillinam, %	11	9	7	6	7
Fluoroquinolone, %	5	11	5	3	6
Nitrofurantoin, %	7	5	5	5	5
Doxycycline, %	2	1	2	1	1
Amoxicillin, %	2	1	2	0.4	1
Amoxicillin clavulanic acid, %	2	1	2	1	1
Fusidic acid, %	1	1	1	1	1
Cefuroxime, %	0.4	3	0.4	0.1	1
Clindamycin, %	1	1	1	1	1
Penicillin, %	2	1	1	1	1
Sulfa-trimethoprim, %	0.1	1	1	0.1	1
Ceftriaxone, %	2	1	1	0	1
Other, %	3	2	1	1	1

5.3 Diagnosis, treatment and prevention of urinary tract infection in long-term care facilities in Central Finland Healthcare District (Study III)

All 25 healthcare centre hospital wards, 39 NHs and dementia units that were visited during 2004–2005 responded to the follow-up postal surveys in 2006, 2007 and 2008. In healthcare centers there were at the time of the site visit 1100 residents and in NHs and dementia units 1221. Urinary catheters were more frequently used in healthcare center wards than in NHs and dementia units (5.1% vs. 2.0%).

In 2005, the diagnosis of UTI was based most commonly on local (81%, 52/64) and general (94%, 60/64) symptoms (Table 16). More than half of the units (59%, 38/64) regarded urine odor as a symptom for UTI and as a reason for taking a urine specimen. Most units used a dipstick in the ward (80%, 51/64). All units sent urine samples for culture, but one unit used only the urine culture, and 12 units sent urine specimens to the laboratory for microscopy and culture without a dipstick. Most units (64%, 41/64) used both the dipstick and also sent specimens to the laboratory for culture and microscopy.

Table 16. How urinary tract infection diagnosis is made (Study III)

UTI diagnosis	Healthcare center hospital wards N=25 n (%)	Nursing homes and dementia units N=39 n (%)
Local symptoms	24 (96)	28 (72)
General symptoms	24 (96)	36 (92)
Odour of urine	12 (48)	26 (67)
Dipstick in the ward	19 (76)	32 (82)
Urine culture	2 (8)	9 (23)
Microscopic examination and urine culture	23 (92)	30 (77)
Other	3 (12)	2 (5)

UTI urinary tract infection

In 2005, the most commonly used drug for UTI treatment was pivmecillinam, while methenamine was used for UTI prevention. The length of UTI treatment varied between 5 and 7 days in 89.4% of the units. Data on methenamine use for UTI prophylaxis was not collected during the baseline visits. In postal surveys, the proportion of patients receiving methenamine for UTI prophylaxis varied between 5.3% and 6.9% in healthcare center hospitals and 8.8% and 11.1% in NHs and dementia units.

At the baseline visits, 23.5% (258/1100) of patients in healthcare center hospitals and 16.6% (203/1221) of residents in NHs and dementia units received antimicrobials (Table 17). The most common indication was prevention of recurrent UTI in all settings.

Table 17. Antimicrobial use by type of setting in Studies I, II, IV and V.

	Study I		Study II		Study IV			Study V
	2004-2005	2006	2007	2008	Apr 2009	Oct 2009	2010	2011
Healthcare center wards, n	25	25	25	25				115
Number of patients	1,100	1,069	1,058	1,039				3,262
Any antimicrobial, %	23.5	19.5	20.7	20.7				18.0
UTI prophylaxis, %	11.1	5.4	5.2	4.9				10.0
Methenamine, %	N/A	N/A	N/A	N/A				6.5
UTI treatment, %	4.5	5.1	5.2	6.2				N/A
Nursing homes and dementia units, n	39	39	39	39	8	8	9	263
Number of patients	1,221	1,211	1,195	1,158	1,706	1,665	2,320	5,262
Any antimicrobials, %	16.6	12.3	12.2	11.3	17.3	13.3	10.3	13.0
UTI prophylaxis, %	14.5	10.9	8.0	7.8	12.0	6.8	6.1	9.0
Methenamine, %	N/A	N/A	N/A	N/A	8.3	4.4	4.0	6.2
UTI treatment, %	2.1	3.0	2.8	1.7	2.1	2.9	1.5	N/A
Sheltered care units, n	58	58						274
Number of patients	1,206	1,181						4,260
Any antimicrobials used total, %	15.9	13.5						17.0
UTI prophylaxis, %	12.3	7.9						12.0
Methenamine, %	N/A	N/A						20.6
UTI treatment, %	1.9	2.6						N/A

UTI, urinary tract infection

At baseline in 2005 in the healthcare center hospitals, UTI prophylaxis was prescribed for 11.1% of the patients and in 2008 only for 4.9% ($p<0.01$). In NHs and dementia units, the corresponding figures were 14.5% and 7.8%. The decrease was statistically significant in both types of settings ($p < 0.001$). In healthcare center hospitals there was a statistically insignificant increase in treatments for acute UTI, from 4.5% to 6.2% ($p = 0.65$). In NHs and dementia units there was a statistically insignificant increase in treatments for acute UTI from 2.1% to 1.7% (p=19). The proportion of patients having urinary catheters increased during the study, mainly in healthcare centre hospital wards (Table 18).

Table 18. Alcohol-based hand rub use (litres/1000 patient-days), MRSA and ESBL carriers and use of urinary catheters by type of settings in Study III

	Baseline visits 2004-2005	Postal surveys		
		2006	2007	2008
Health care center N=25				
Number of patients	1100	1069	1058	1038
Use of hand rub, l/1000 patient-days (mean)	10.9	15.2	17.6	17.4
MRSA carriers, n (%)	7 (0.6)	20 (1.8)	17 (1.6)	13 (1.3)
ESBL carriers, n (%)	11 (1.0)	8 (0.7)	15 (1.4)	20 (1.9)
Urinary catheters, n (%)	57 (5.2)	77 (7.2)	82 (7.8)	84 (8.1)
Nursing homes N=29				
Number of patients	1080	1096	1069	1039
Use of hand rub, l/1000 patient-days (mean)	9.0	12.5	14.6	12.5
MRSA carriers, n (%)	12 (1.1)	31 (2.8)	27 (2.5)	13 (1.3)
ESBL carriers, n (%)	4 (0.4)	7 (0.6)	9 (0.8)	9 (0.9)
Urinary catheters, n (%)	24 (2.2)	28 (2.6)	28 (2.6)	31 (3.0)
Dementia units N=10				
Number of patients	141	115	126	119
Use of hand rub, l/1000 patient-days (mean)	4.1	10.8	8.7	10.2
MRSA carriers, n (%)	0 (0)	0 (0)	0 (0)	2 (1.7)
ESBL carriers, n (%)	0	0	0	0
Urinary catheters, n (%)	0	0	1 (0.8)	1 (0.8)
Sheltered care units N=55				
Number of patients	1176	1151	1200	1242
Use of hand rub, l/1000 patient-days (mean)	5.4	7.3	7.3	10.5
MRSA carriers, n (%)	4 (0.3)	7 (0.6)	5 (0.4)	9 (0.7)
ESBL carriers, n (%)	6 (0.5)	9 (0.8)	14 (1.2)	11 (0.9)
Urinary catheters, n (%)	15 (1.3)	22 (1.9)	17 (1.4)	21 (1.7)
All facilities N=119				
Number of patients	3497	3431	3453	3438
Use of hand rub, l/1000 patient-days (mean)	7.3	10.5	11.3	12.4
MRSA carriers, n (%)	23 (0.7)	58 (1.7)	49 (1.4)	37 (1.1)
ESBL carriers, n (%)	21 (0.6)	24 (0.7)	38 (1.1)	40 (1.2)
Urinary catheters, n (%)	96 (2.7)	127 (3.7)	128 (3.7)	135 (3.9)

MRSA, methicillin resistant *Staphylococcus aureus*

ESBL, extended-spectrum beeta-lactamase-producing *Enterobacteriaceae*

5.4 Risk factors for antimicrobial prescriptions

Study IV and V

Potential risk factors for antimicrobial prescription identified by univariate analysis included disorientation (p = 0.01), incontinence (p = 0.07) and male gender (p = 0.025) (Study IV). Disorientation and incontinence were strongly associated and could not be included simultaneously in the multivariate analysis. The proportion of male residents was relatively low and the gender data were not available for all three surveys. Thus, the multivariate analysis gave no additional information compared with the univariate results. When methenamine was excluded from the antimicrobials, the risk factors identified by the univariate analysis were age over 85 years (p = 0.02) and wounds (p = 0.04), between which there was strong association.

Table 19 shows the risk factors identified for antibiotic prescription (Study V). Of the nine risk factors listed in the table, three are similar to those detected previously (Study IV): urinary incontinence, confusion by the NH confusion assessment method, and pressure ulcers.

Table 19. Characteristics of residents with and without antimicrobials in Study V.

	Residents without antimicrobials	Residents with all antimicrobials	Residents with antimicrobials except methenamine
Numbers of residents	10,771	2,013	1,172
Age >85 years, n (%)	5,775 (54)	949 (47)	580 (49)
Female residents, n (%)	7,471 (69)	1627 (81)	906 (77)
Urinary catheters, n (%)	314 (3)	199 (10)	113 (10)
Urinary incontinence (3-4), n (%)	7406 (69)	1468 (73)	829 (71)
Cognitive Performance Scale 3+, n (%)	6162 (57)	1501 (75)	855 (73)
Acute confusion, n (%)	753 (7)	184 (9)	126 (11)
Bedridden, n (%)	2483 (23)	517 (26)	306 (26)
Skin ulcers (due to any cause), n (%)	862 (8)	246 (12)	159 (14)
Diarrhea, (%)	1044 (10)	244 (12)	145 (12)
Residents with hospital stay*, n (%)	1295 (12)	370 (18)	254 (22)

*hospital stays in the previous 90 days, p<0.01

5.5 Infections

Study V

The most common infection involved urinary tract (n=1,002), followed by wound infection (n=267), pneumonia (n=219), other respiratory infection (n=189), and *Clostridium difficile* (n=70) (Table 20). The prevalence of UTIs (10% vs. 6% and 8%), wound infection (3% vs. 2%), and pneumonia (3% vs. 1%) was slightly higher in healthcare center wards than in NHs and sheltered care units, as were rates for *Clostridium difficile* (1% vs. 0.3% and 0.4%). Residents with infections or colonization or both caused by multi-drug resistant bacteria were more common inhealthcare center hospitals and NHs than in sheltered care units (7% vs. 3%).

Table 20. Infections and antibiotic resistant bacteria by different type of settings in Study V

	Healthcare center ward N=115	**Nursing homes N=263**	**Sheltered care units N=274**	**All N=652**
All	3262	5262	4260	12784
UTI, n (%)	316 (10%)	334 (6%)	352 (8%)	1002 (8%)
Wound infection, n (%)	83 (3%)	90 (2%)	94 (2%)	267 (2%)
Pneumonia, n (%)	83 (3%)	75 (1%)	61 (1%)	219 (2%)
Respiratory infection, n (%)	48 (1%)	85 (2%)	56 (1%)	189 (1%)
Clostridium difficile, n (%)	36 (1%)	18 (0.3%)	16 (0.4%)	70 (1%)
Conjunctivitis, n (%)	17 (0.5%)	22 (0.4%)	11 (0.3%)	50 (0.4%)
Septicemia, n (%)	8	3	3	14 (0.1%)
Antibiotic resistant microbes (MRSA, ESBL *E.coli*,VRE)	227 (7%)	367 (7%)	130 (3%)	724 (6%)

UTI urinary tract infection, MRSA methicillin resistant *Staphylococcus aureus*, ESBL extended-spectrum-beeta-lactamase-producing, VRE vancomycin resistant *Enterococcus*

5.6 Hand rub use

Study I, III

One year after the baseline visits, the increase of the mean amount of alcohol-based hand rubs was statistically significant in all units. The mean for change was in healthcare center hospitals 4.5L/1000 patient-days (95% CI 1.65-7.42), in NHs 3.6L/1000 patient-days (95% CI 0.98-7.54), in the dementia units 6.7L/1000 patient-days (95% CI 2.55-14.4) and in sheltered care units 2.0L/1000 patient days (95% CI 0.89- 3.34). Figure 1 shows the distribution of the amount of hand rub used by type of setting at the site visit and changes

in use between the site visit and the follow-up. In over 25% of the facilities, excluding dementia units, the use of hand rub diminished.

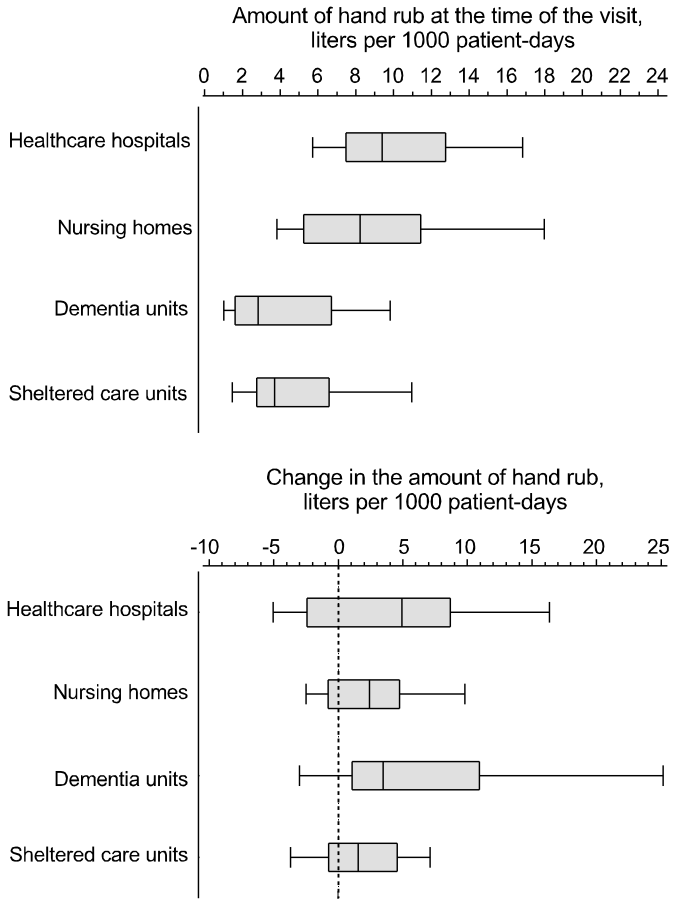

Figure 1. Amount of hand rub used at time of site visit by type of setting and changes in use between site visits in 2004-2005 and results of the follow-up postal survey on October 3, 2006. Medians, with interquartile ranges (box) and with 10th and 90th percentiles (whiskers).

A total of 119 units (25 healthcare center wards, 29 NHs, 10 dementia units, and 55 sheltered care units) with an average of 3,455 (range 3497-3438) residents participated in all steps: baseline visit, and three annual postal surveys. The total amount of hand rub used increased by 70%, from the mean 7.3 (SD 5.1) L/1000 patient-days at the visits during 2004-2005 to 12.4 (SD 14.9) L in 2008 (Table 18). The newly obtained level in 2006 was sustained until 2008. At the site visits, the overall carrier rate for MRSA was 0.7% and for ESBL 0.6%. Both rates nearly doubled during the follow-up (Table 18)

6 Discussion

6.1 Prevalence of antimicrobial prescription in long-term care facilities

Our studies showed that in Finnish LTCFs the prevalence of antimicrobial prescription was high (10-19%), compared with prevalence studies published in other countries (3-12%) [11, 78-87]. The most common indication for antimicrobial use was UTI prophylaxis (42-69%). Methenamine was the most commonly prescribed antimicrobial in all our studies (36-40%). In the ESAC NH study, methenamine was less commonly prescribed (12-18%) [12]. In Finnish NHs participating in the ESAC/HALT studies, methenamine accounted for 48-49% of all antimicrobials prescribed, which did the most to explain our high prevalence [12]. Its use was also common in Denmark and Norway [12]. Finnish statistics on medicines from 2010 showed that methenamine was consumed at 1.99 DDD/1000 inhabitants [162]. Trimethoprim, another drug commonly prescribed for UTI prophylaxis, was less used (1.14 DDD/1000 inhabitants). Of methenamine, 22% was used in healthcare facilities [162]. The Cochrane review concluded that there was little evidence to support long-term use of methenamine to prevent UTIs [163]. Although methenamine does not cause resistance, it increases costs and possible adverse events. There is a place for well-conducted randomized controlled trials of methenamine vs. placebo. Cranberry products have not been proven to prevent UTIs [164]. Nitrofurantoin can cause severe side effects, especially in elderly persons [165]. Its use for UTI prophylaxis caused us concern.

We did not determine how often the antibiotic prescription was made by telephone. In Sweden, prescriptions were issued by telephone, fax or e-mail in 38% [93]. In Canada physicians paid bedside visist before prescription in 44% of cases [98].

6.2 Urinary tract infection prophylaxis and diagnosis in long-term care facilities

Our studies suggest that it is possible to influence antimicrobial prescription for UTI prophylaxis. In Central Finland healthcare District, we published local guidelines after our site visits [166]. A paper copy of the guidelines was sent to all LTCFs in the region. Thereafter, prescriptions for UTI prophylaxis decreased significantly from 13% to 6% (Studies I, II). The same occurred in NHs participating in the ESAC/HALT surveys, from 12% to 6% (Study IV), although there we only conducted the surveys and gave feedback. The prevalence figures for antimicrobial use in Ireland and Northern Ireland were similar to our results (10-13%). UTI prophylaxis formed 36-47% [83, 100].

In our study, 80% of the units performed dipstick analyses in the wards. The diagnosis of UTI is difficult. In the LTCFs urine specimens were the only diagnostic tool available. Any symptom can easily be considered to stem from UTI and personnel are often busy taking urine specimens. All other reasons for the symptoms must first be ruled out before treatment for UTI. When symptoms are considered to be caused by UTI, urine specimens for culture should be taken and UTI treatment started. Finnish Current Care guidelines for UTI have a section on UTI in LTCF residents with a flowchart showing when to take a urine culture [142]. LTCF staff may not be aware of this section or cannot distinguish it from the extensive guidelines. They could benefit from specific guidelines prepared only for LTCFs, as in Ireland [167].

6.3 Surveillance of healthcare-associated infections

The prevalence of UTI was 8%, RTI 3%, and skin infection 2% (Study V). However, there were no clear definitions for the infections. The data collection covered a 7-day period, possibly explaining why the prevalence of infections was slightly higher than in studies in other countries 3-12% (Table 2).

The symptoms and signs of residents are not always recorded in their files, nor is the indication for antimicrobial prescription [78]. The MDS-LTCF recorded antimicrobial prescriptions and infections without any special guidance. Thus, we could have missed some infections, such as diarrhea or mild RTI, for which antimicrobials are not always used. In the HALT study, signs and symptoms of disease were recorded and afterwards McGeer criteria were applied (data not shown). Not all symptoms and signs are, however, caused by infections. The definitions are important when comparing and benchmarking LTCFs, as well as characteristics of the resident population, i.e. case mix. Seasonality may also influence the prevalence of infection, especially RTI [87].

The Netherlands have had a sentinel surveillance network for infectious diseases in NHs since 2009. Every week, a physician or nurse practitioner records the number of gastroenteritis, probable pneumonia, influenza like illness, and UTIs according to the way physicians diagnose the infections in NH residents [168].

France has had a reporting system for LRTI outbreaks in NHs since 2003. NHs report LRTI outbreaks to local public health authorities [72]. They verify the implementation of appropriate control measures with the NH and inform the National Public Health Institute. The reporting builds communication between NHs and public health professionals and facilitates outbreak management [72].

In Finland, we could utilize a similar system already in use for food poisoning and water outbreaks (RYMY) to report RTI and gastroenteritis epidemics in LTCFs [169]. Communication between regional infection control unit and LTCFs is crucial.

6.4 Risk factors for healthcare-associated infections in long-term care facilities

Many of the risk factors for HAI are not changeable such as age, sex, comorbidities, and length of stay. In our studies, urinary catheter use was 1-7%. These figures are in line with

the recent European figures (5.6-12.0%) [86]. The use of urinary catheters are continued in futile when the patient is transferred from an acute-care hospital to a healthcare center hospital. Urinary catheter use should be kept to a minimum. The reason for catheter use and the date when the catheter was set should be in the resident's notes. Very few vascular catheters were used in our study of LTCFs.

The number of residents with impaired motility was 1-52% compared with the European figures of 35-57% [86]. The lowest prevalence of bedridden residents in our studies was in sheltered care units: 1-9%. In our studies the prevalence of skin ulcers was 3-11%. The corresponding European figures were 7-15% [86]. LTCFs should have all possible means to prevent skin ulcers, especially pressure ulcers. It is an important quality of care indicator.

6.5 Antimicrobial resistance and *Clostridium difficile*

In Finland the prevalence of multidrug-resistant organisms was low [170,171]. We showed MRSA carrier rates of 0.7-1.7% and ESBL carrier rates of 0.6-1.7% (Study I-III). The prevalence of residents colonized with MRSA, ESBL-producing *Enterobacteria*e or VRE was higher (3-7%) (Study V). We do not know the reason for the higher prevalence; transmission may have resulted from acute care or in LTCFs. ESBL-producing *Enterobacteriaceae* are increasing, both in community and in acute-care hospitals in Finland [170]. In the study from the Netherlands, the prevalence of residents colonized or infected with multidrug-resistant organisms was lower (0.2 -0.6%) [75]. Reporting of extremely multidrug-resistant organisms, such as carpapenemase-resistant *Enterobacteriaceae* could be organized the same way as outbreaks in France [72], where NHs report LRTI outbreaks early to local public health authorities.

Our study suggested a prevalence of *Clostridium difficile* between 0.3% and 1.0% (Study V). In LTCFs in Germany, the prevalence of *Clostridium difficile* was 4.6% [38]. However, *Clostridium difficile* is an even larger problem in LTCFs in the USA (4-20%) [39].

6.6 Infection control in long-term care facilities

Only 1/9 study NHs in the ESAC/HALT surveys had an infection control committee (Study IV). Few LTCFs in practice have sufficient in-house expertise in infectious diseases and infection control. A link nurse system, such as in acute-care hospitals [172], could be a way to maintain ongoing collaboration and training activities between LTCFs and regional infection control experts, which could also guarantee the implementation of national and regional guidelines in practice.

Use of alcohol-based hand rub increased from 7.3L/1000 patient-days to 12.4 L [Study III], very likely reflecting improvements in hand hygiene practices. The increase occurred in all types of settings and was sustained during the 3-year follow-up. In Norway during the National Hand Hygiene Campaign hand rub use increased from 2.4 L to 11 L/ 1000 resident-days [117]. In comparison in Finnish acute care hospitals the median amount of hand rub used was 47L/1000 patient days [173]. We did not observe hand hygiene

compliance. In previous studies, the compliance varied between 15-62% [117,120-123]. Our results show that LTCFs do learn to use alcohol-based hand rubs, as shown in previous studies [124-128]. Pocket-sized bottles of alcohol-based hand rub could be practical in LTCF use as suggested earlier in hospitals [7]. Continuous training and follow-up is needed to preserve this positive trend and direct observations to assess whether hand hygiene is performed correctly and at the right time. LTCFs need training material specially made for their purposes. In addition, every facility should monitor the amount of alcohol-based hand rub used per year.

6.7 Feasibility of various surveillance methods

Most of the results were very similar with the three methodologies we used.

The MDS provides a feasible tool for collecting data on antimicrobial use and infections in LTCFs. A question on indication for antimicrobial prescription could be added to the data collection: whether the antimicrobial is prescribed for prophylaxis or treatment, as well as infection site. Written definitions for infections including specific criteria could also be helpful. The RAI-LTC instrument covers more data on resident characteristics than were collected in the ESAC/HALT surveys, thus allowing further adjustment accordingly. The RAI-LTC instrument with these small changes could provide the data that the facility needs for improving infection control.

For the local infection control team, visits to the LTCFs in their region can be very useful. Communication can be easier if the situation in the LTCF is known. Infection control and geriatric unit could benefit from teamwork when collaborating with the LTCFs. It is not feasible only to send questionnaires to the LTCFs for data collection. In most of the LTCFs, the personnel have no time or capability for filling them out. Web-based questionnaires could be one choice, but they should be very simple.

In the ESAC/HALT surveys, the district infection control nurse and the head nurse from the facility collected the information. It must be borne in mind that a prevalence survey also constitutes a type of training for the LTCF, in addition to data collection. The feedback is a crucial part of it.

6.8 Limitations of the study

Our results do not necessarily represent the usual LTCF situation throughout Finland. In Central Finland Healthcare District we visited all the LTCFs. The NHs participated voluntarily in the surveys (Study IV).The NHs were from four healthcare districts and all were public institutions. The LTCFs using RAI-LTCF could have been institutions that are specifically interested in the quality and improvement of their services. However, the majority of healthcare districts participated in study IV and V, covering 21-40% of all LTC residents in Finland.

Future analysis by type of setting may not be relevant, because continuous changes in the organization of LTC. Resident characteristics, i.e. case mix, are more important. The type of facility alone is not indicative of the condition of the residents.

In the amount of alcohol-based hand rub, reporting error cannot be ruled out. It would have been more accurate if the units reported the annual amount of alcohol-based hand rub they had ordered. We did not take any bacterial cultures; neither do we know whether the increased carrier rate of ESBL and MRSA had been transferred from acute-care hospitals to LTCFs or if transmission had occurred in the LTCFs.

Reporting and calculations of antimicrobials in the Central Finland surveys differed from those in the ESAC/HALT and RAI -surveys. This could partly explain the higher prevalence. In the ESAC/HALT surveys, the background data were institutional data not on the resident level. Due to the small numbers, the results of risk factors for antimicrobial use should be interpreted with caution. However, the RAI-LTC data confirmed several risk factors for antimicrobial use, some of which were the same as in ESAC/HALT survey.

6.9 Future considerations

The existing network of RAI nurses could be complemented by nurses responsible for infection control, forming a link nurse system like that in acute-care hospitals [172]. This could help to maintain collaboration and training activities between LTCFs and regional as well as national infection control experts; this could then guarantee the implementation of national and regional infection control guidelines in practice. Infection control experts and geriatricians should also collaborate at the local, regional, and national levels.

The experiences from our site visits could be used in planning and implementing a national program for infection control in LTCFs. Such a program should include a prevalence study of HAIs, which could also increase awareness of infection control and its importance.

7 Recommendations

1. Antibiotic use was common in LTCFs in Finland and most were used for UTI prophylaxis and treatment. The decreases in antimicrobial usage during the surveys suggest that LTCFs may benefit from antimicrobial stewardship interventions, especially those focused on UTI.

2. Methenamine use was very popular, although its ability to prevent UTI is questionable, and its wide use should be re-evaluated.

3. Wounds are a major preventable risk factor for HAI as are urinary catheters. Urinary catheter use should be minimized. LTCFs should use all means to prevent pressure ulcers.

4. Continuous training and observation of hand hygiene compliance is necessary. Every facility should at least collect data on hand rub consumption. Compulsory hand hygiene proficiency training and test, such as Hygiene Passport, could be useful.

5. The RAI-LTC instrument with small changes such as indication for antimicrobial prescription and written definitions for infections, could be used for collecting data on antimicrobial use and infections in LTCFs. Its use could be made compulsory for LTCFs, as it is in Canada and the USA.

6. The system currently in use currently for food poisoning and water outbreaks could be set up for reporting RTI or gastroenteritis epidemics as well as extremely resistant bacteria in LTCFs, to regional and national infection control units to improve outbreak management and save lives.

8 Acknowledgements

This study was carried out at the Department of Infectious Disease Surveillance and Control of the National Institute for Health and Welfare (THL), Central Finland Healthcare District and LTCFs in Finland.

I thank Professor Pekka Puska, Director General of THL, Research Professor Petri Ruutu, Director of the Department of Infectious Disease Surveillance and Control of THL and Senior Medical Officer Markku Kuusi, PhD, Head of Epidemiologic Surveillance and Response Unit of THL for providing excellent research facilities. I owe special thanks to former head of Emergency Department of Central Finland Healthcare District Jorma Teittinen, MD and the present head of Emergency Department of Central Finland Healthcare District Heikki Janhunen, MD for their encouragement and support in my work.

My warmest gratitude goes to my supervisors, docent Outi Lyytikäinen, MD and Pertti Karppi, MD, PhD. Without their visions, encouragement and support this thesis would not have materialized. Outi´s enthusiasm and patient encouragement have taken me through all the practical challenges during my work. She always found time for me despite her unlimited number of other duties. Pertti initiated this work and shared his knowledge and clinical expertise in the field of geriatrics. He always found time to help me whenever I needed. I thank Pertti for safe driving (3300 km) during our LTCF visits. Pertti also introduced us to many attractions in Central Finland during our site visits.

I thank the personnel in the various participating LTCFs. Without their contribution this thesis would not have been possible.

I warmly thank to the official reviewers Professor Kaisu Pitkälä, MD and Docent Hannu Syrjälä, MD for their constructive critiques.

I thank docent Harriet Finne-Soveri and Senior Medical Officer Matti Mäkelä PhD. They familiarized me with RAI. I thank Mr James Thompson for his skillful revision of the language.

My warmest gratitude goes to Aino Jakobsson. Her practical knowledge of infection control and great sense of humor made our journeys to LTCFs very enjoyable.

Thanks to my colleagues Jaana Leppäaho-Lakka MD, Ms Tiina Tiitinen, Ms Maire Matsinen and Ms Liisa Lauritsalo at my Unit in Central Finland Healthcare District for understanding and support during these years.

I thank all my co-authors for their contribution. I thank Hannu Kautiainen MSc, Salme Järvenpää MSc and Jukka Ollgren MSc for their statistical advice. I thank colleagues at THL specially Mr Tommi Kärki and my roommates Elisa Huovinen MD, PhD and Eija Hiltunen–Back MD, PhD for encouragement, practical advice and friendship. I thank Ms Marja Palander and Ms Laura Pentikäinen for their excellent secretarial services. I thank Ms Kirsi Närhi at THL Jyväskylä unit. She was always there when I had problems with computer.

This work has been financially supported by the Uulo Arhio Foundation, Central Finland Healthcare District and the Finnish Medical Foundation to whom I am sincerely grateful.

My warmest gratitude goes to my husband Jorma and my son Otto for their love and support, humor and patience. I thank Heidi and Janne for their support.

9. References

1. Care and attention on a 24-hour basis. Working group Memorandum. Ministry of Social Affairs and Health 2010:28. ISBN 978-952-00-3075-9. http://www.stm.fi/c/document_library/get_file?folder Id=2872962&name=DLFE-14929.pdf.
2. Population structure 2010. Official statistics of Finland.
3. Institutional care and housing services in social care 2009 and 2010. National Institute of Health and Welfare, Helsinki. Finland www.thl.fi.
4. OECD Help wanted. http://www.oecd.org/els/healthpoliciesanddata/47836116.pdf
5. Strausbaugh LJ. Emerging health care-associated infections in geriatric population. Emerg Infect Dis 2001;7:268-271.
6. Van de Sande-Bruinsma N, Grundmann H, Verloo D, Tiemersma E, Monen J, Goossens H et al. Antimicrobial drug use and resistance in Europe. Emerg Infect Dis 2008;14:1722-30.
7. Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. Lancet 2000;356:1307-12.
8. Schweizer AK, Hughes CM, Macauley DC, O'Neill C. Managing urinary tract infections in nursing homes: a qualitative assessment. Pharm World Sci 2005;27:159-65.
9. Katz PR, Beam TR, Brand F, Boyce K. Antibiotic use in nursing home. Arch Intern Med 1990;150:1465-68.
10. Warren JW, Palumbo FB, Fitterman L, Speedie SM. Incidence and characteristics of antibiotic use in aged nursing home patients. J Am Geriatr Soc1991;39:963-72.
11. Andersen BM, Rasch M. Hospital-acquired infection in Norwegian long-term care institutions. A three year survey of hospital-acquired infections and antibiotic treatment in nursing/residential homes, including 4500 residents in Oslo. J Hosp Infect 2000;46:288-296.
12. McClean P, Hughes C, Tunney M, Goossens H, Jans B on behalf of the ESAC Nursing home Project Group. Antimicrobial prescribing in European nursing homes. J Antimicrob Chemother 2011;66:1609-16.
13. Latour K, Catry B, Broex E, Vankerckhoven V, Muller A Stroobants R, Goossens H et al. Indications for antimicrobial prescribing in European nursing homes: results from a point prevalence survey. Pharmacoepidemiology and drug safety 2012: DOI:10.1002/pds.3196.
14. Nicolle LE. The SHEA long-term-care committee. Urinary tract infections in long-term-care facilities. Infect Control Hosp Epidemiol 2001;22:167-75.
15. Finne-Soveri H, Hammar T, Noro A. Measuring the quality of long-term institutional care in Finland. Eurohealth. 2010;**16**:8-10.
16. Horan TC, Andrus M, Dudeck MA. CDC/NHSN surveillance definition of healthcare-associated infection and criteria for specific types of infections in the acute care settings. Am J Infect Control 2008;36:309-32.
17. Craig A, Mitchell MD, Doshi JA, Agarwal R, Williams MD, Brennan PJ. Estimating the proportion of Health-care associated infections that are reasonably preventable and the related mortality and costs. Infect Control Hosp Epidemiol 2011;32:101-114.
18. European Centre for Disease Prevention and Control (ECDC). Annual epidemiological report on communicable diseases in Europe 2008. Stockholm: ECDC; 2008. Available from: http://ecdc.europa.eu/en/publications/Publications/0812_SUR_Annual_Epidemiological_Report_2008.pdf
19. Kanerva M, Ollgren J, Virtanen MJ, Lyytikäinen O. Estimating the annual burden of healthcare-associated infections in Finnish acute care hospitals. Am J Infect Control 2009;37:227-30.

20. Suetens C. Healthcare associated infections in European long-term care facilities: How big is the challenge? Euro Surveill 2012;17(35):pii=20259.
21. Jarvis WR. Infection control and changing health-care delivery systems. Emerg Infect Dis 2001;7:170-173.
22. Munoz-Price LS. Long-term acute care hospitals Clin Infect Dis 2009;49:438-43.
23. Quanch C, McArthur M, McGeer A, Li L, Simor A, Dionne M et al. Risk of infection following a visit to the emergency department: a cohort study. CMAJ 2012. DOI:10.1503/cmaj.110372.
24. Yoshikawa TT. Epidemiology and unique aspects of aging and infectious disease. Clin Infect Dis 2000;30:931-33.
25. Castle SC. Clinical relevance of age-related immune dysfunction. Clin Infect Dis 2000;31:578-85.
26. van Duin D. Diagnostic challengies and opportunities in older adults with infectious diseases. Clin Infect Dis 2012;54:973-8.
27. High KP, Bradley SF, Gravenstein S, Mehr DR, Quagliarello VJ, Richards C et al. Clinical guidelines for evaluation of fever and infection in older adult residents of long-term care facilities: 2008 update by Infectious Diseases Society of America. Clin Infect Dis 2009;48:149-71.
28. Effros RB, Fletcher CV, Gebo K, Halter JB, Hazzard RH, McFarland Horne F, Huebner RE. Workshop on HIV infection and aging: What is known and future research directions. Clin Infect Dis 2008;47:542-53.
29. Mayhall GC Hospital epidemiology and infection control. 3rd edition 2004. Lippincott Williams &Wilkins.
30. Guinoz Y. The mini nutritional assessment (MNA) review of the literature-What does it tell us? J Nutr Health Aging 2006;10:466-85.
31. Katona P, Katona-Apte J. The interaction between nutrition and infection. Clin Infect Dis 2008;46:1582-8.
32. High KP. Nutritional strategigies to boost immunity and prevent infection in elderly individuals. Clin Infect Dis;2001:1892-1900.
33. O'Fallon E, Pop-Vicas A, D'Agata E. The emerging threat of multidrug-resistant gram-negative organisms in long-term care facilities. J Gerontol A Biol Sci Med Sci 2009;64A:138-141.
34. Nicolle LE. Asymptomatic bacteriuria: review and discussion of the ISDA guidelines. Int J Antimicrob Agents 2006;28S:S42-S48.
35. Nicolle LE, Bradley S, Colgan R, Rice JC, Schaeffer A, Hooton M. Infectious Diseases Society of America Guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. Clin Infect Dis 2005;40:643-54.
36. Juthani-Mehta M, Quagliarello V, Perelli E, Towle V, Van Ness PH, Tinetti M. Clinical features to identify urinary tract infection in nursing home residents: A cohort study. J Am Geriatr Soc 2009;57:963-970.
37. Nicolle LE. The chronic indwelling catheter and urinary infection in long-term-care facility residents. Infect Control Hosp Epidemiol 2001;22:316-321.
38. Arvand M, Moser V, Schwehn C, Bettge-Weller G,Hensgens MP, Kuijper EJ. High prevalence of Clostridium difficile colonization among nursing home residents in Hesse, Germany.PlosOne 2012;7(1):e30183
39. Simor AE, Bradley SF, Strausbaugh LJ, Crossley K, Nicolle LE. Clostridium difficile in long-term-care facilities for the elderly. Infect Control Hosp Epidemiol 2002;23:696-703.
40. Abraham NS Proton pump inhibitors: potential adverse effects.Curr Opin Gastroenterol 2012;28:615-20.
41. Teramura-Grönblad M, Hosia-Randell H, Muurinen S, Pitkälä K. Use of proton-pump inhibitors and their associated risks among frail elderly nursing home residents.
42. Dorner B, Posthauer ME, Friedrich EK, Robinson GE. Enteral nutrition for older adults

in nursing facilities. Nutr Clin Pract 2011;26:261-272.

43. Muder RR, Aghababian RV, Loeb MB, Solot JA, Higbee M. Nursing home-acquired pneumonia: an emergency department treatment algoritm. Curr Med Res opin 2004;20:1309-20.
44. Vergis EN, Brennen C, Wagener M, Muder RR. Pneumonia in long-term care A prospective case-control study of risk factors and inpact on survival. Arch Intern Med 2001;161:2378-2381.
45. Muder RR. Pneumonia in residents of long-term care facilities: epidemiology, management, and prevention. Am J Med 1998;105:319-330.
46. Säynäjäkangas P, Keistinen T, Tuuponen T. Seasonal fluctuations in hospitalization for pneumonia in Finland. Int J Circumpolar Health 2001;60:34-40.
47. Engelhart ST, Hanses-Derendorf L, Exner M, Kramer MH. Prospective surveillance for healthcare-associated infections in German nursing home residents. J Hosp Infect 2005 ;60 :46-50.
48. Smith PW, Bennet G, Bradley S, Drinka P, Lautenbach E, Marx J et al. SHEA/APIC Guideline: Infection prevention and control in the long-term care facility. Am J Infect Control 2008;36:504-35.
49. Lyder CH. Pressure ulcer prevention and management. JAMA 2003;**289**(2):223-6.
50. Park-Lee E, Caffrey C. Pressure ulcers among nursing home residents: United States – 2004. NCHS Data Brief 2009;**14**:1-6.
51. Vorou R, Remoudaki HD, Maltezou HC. Nosocomial scabies. J Hosp Infect 2007;65:9-14.
52. Mylotte JM. Nursing home-acquired bloodstream infection. Infect Control Hosp Epidemiol 2005;26:833-837.
53. Nicolle LE, Strausbaugh LJ, Garbaldi RA. Infections and antibiotic resistance in nursing homes. Clin Microbiol Rev 1996;9:1-17.
54. Crossley K Long-term care facilities as sources of antibiotic-resistant nosocomial pathogens. Curr Opin Infect Dis 2001;14:455-459.
55. Eveillard M, Charru P, Rufat P, Hippeaux M-C, Lancien E, Benselama F et al. Methicillin-resistant Staphylococcus aureus carriage in long-term care facility: hypothesis about selection and transmission. Age Aging 2008;37:294-299.
56. Cohen AE, Lautenbach E, Morales KH, Linkin DR. Fluoroquinolone-resistant Eschericia coli in the long-term care setting. Am J Med 2006;119:958-63.
57. Tinelli M, Cataldo MA, Mantengoli E, Cadeddu C, Cunietti E, Luzzarro F et al. Epidemiology and genetic characteristics of extended-spectrum β-lactamase-producing gram-negative bacteria causing urinary tract infections in long-term care facilities. J Antimicrob Chemother 2012 doi:10.1093/jac/dks300
58. Dulon M, Haarmann F, Peters C, Schblon A, Nienhaus A. MRSA prevalence in European healthcare settings: a review. BMC Infectious Diseases 2011;11:138.
59. Suetens C, Niclaes L, Jans B, Verhaegen J, Schuermans A, Van Eldere J et al. Determinants of meticillin-resistant Staphylococcus aureus carriage in nursing homes Age Aging 2007;36:327-330.
60. Aizen E, Ljubuncic Z, Ljubuncic P, Aizen I, Potasman I. Risk factors for methicillin-resistant Staphylococcus aureus colonization in geriatric rehabilitation hospital. J Gerontol A Biol Sci Med Sci 2007;62:1152-1156
61. Kerttula A-M, Lyytikäinen O, Salmenlinna S, Vuopio-Varkila J. Changing epidemiology of methicillin-resistant Staphylococcus aureus in Finland. J Hosp Infect 2004;58:109-14.
62. Benenson S, Cohen MJ, Block C, Stern S, Weiss Y, Moses AE. Vancomycin-resistant Enterococci in long-term care facilities. Infect Control Hosp Epidemiol 2009;30:786-789.
63. Fisch J, Lansing B, Wang L, Symons K, Cherian K, McNamara S et al. New acquisition of

antibiotic-resistant organisms in skilled nursing facilities. J Clin Microbiol 2012;50:1698-1703.

64. Gaviria D, Bixler D, Thomas CA, Ibrahim SM, Kallen A, Limbago B et al. Carbapenem – resistant Klebsiella pneumonia associated with a long-term care facility – west Virginia, 2009-2011. Morb Mortal Wkly Rep 2011;60:1418-20.
65. March A, Aschbacher R, Dhanji H, Livermore DM, Böttcher A, Sleghel F et al. Colonization of residents and staff of a long-term-care facility and adjacent acute-care hospital geriatric unit by multiresistant bacteria. Clin Microbiol Infect 2010;16:934-944.
66. Rooney PJ, O'Leary MC, Loughrey AC, McCalmont M, Smyth B, Donaghy P et al. Nursing homes as a reservoir of extended-spectrum β-lactamase (ESBL)-producing ciprofloxacin-resistant Eschericia coli. J Antimicrob Chemother 2009;64:635-641.
67. Stuart RL, Kotsanas D, Webb B, Vandergraaf S, Gillespie EE, Hogg GG et al. Prevalence of antimicrobial-resistant organisms in residential aged care facilities. Med J Aust 2011;195:530-533.
68. Andersson H, Lindholm C, Iversen A, Giske CG, Örtqvist Å,Kalin M et al. Prevalence of antibiotic-resistant bacteria in residents of nursing homes in a Swedish municipality: Healthcare staff knowledge of and adherence to principles of basic infection prevention. Scan J Infect Dis 2012;44:641-649.
69. Rhinehart E, Walker S, Murphy D, O'Reilly K, Leeman P. Frequency of outbreak investigations in US hospitals: results of a national survey of infection preventionists. Am J Infect Control 2012;40:2-8.
70. Behnke M, Weitzel-Kage D, Hansen S, Eckstein M, Stolzenhain T, Gastmeier, P. www.outbreak-database.com. Last retrieved in: February 2012.
71. Utsumi M, Makimoto K, Quroshi N, Ashida N. Types of infectious outbreaks and their impact in elderly care facilities: a review of the literature. Age Aging 2010;39:299-305.
72. Vaux S, Poujol I, Bonmarin I, Levy-Bruhl D, Desenclos J-C. Surveillance of lower respiratory tract infections outbreaks in nursing homes in France. Eur J Epidemiol 2009;24:149-155.
73. Haley RW, Culver DH, White JW,Morgan WM, Emori TG, Munn VP, Hooton TM. The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals. Am J Epidemiol 1985;121:182-205.
74. Stevenson KB. Regional data set of infection rates for long-term care facilities: description of a valuable benchmarking tool. Am J Infect Control 1999;27:20-6.
75. Eikelenboom-Boskamp A, Cox-ClaessensJHM, Boom-Poels PGM, Drabbe MIJ, Koopmans RTCM, Voss A. Three-year prevalence of healthcare-associated infections in Dutch nursing homes. J Hosp Infect 2011;78:59-62
76. McGeer A, Campbell B, Emori TG, Hierholzer WJ, Jackson M, Nicolle LE et al. Definitions of infection surveillance in long-term care facilities. Am J Infect Control 1991;19:1-7.
77. Stone ND, Ashraf MS, Calder J, Crnich CJ, Crossley K, Drinka PJ et al. Surveillance definitions of infections in long-term care facilities: Revisiting the McGeer criteria. Infect Control Hosp Epidemiol 2012; 33:965-977.
78. Moro ML, Mongardi M, Marchi M, Taroni F. Prevalence of long-term care acquired infections in nursing and residential homes in the Emilia-Romagna region. Infection 2007;35:250-255
79. Eriksen HM, Iversen BG, Aavitsland P. Prevalence of nosocomial infections and use of antibiotics in long-term care facilities in Norway, 2002 and 2003. J Hosp Infect 2004;57:316-320.
80. Tsan L, Davis C, Langberg R, Hojlo C, Pierce J, Miller M et al. Prevalence of nursing home-associated infections in the department of Veterans Affairs nursing home care units. Am J Infect Control 2008;36:173-9.

81. Tsan L, Landberg R, Davis C, Phillips Y, Pierce J, Hojlo C et al. Nursing home-associated infections in department of Veterans Affairs community living centers. Am J infect Control 2010;38:461-6.
82. Chami K, Gavazzi G, Carrat F, de Wazieres B, Lejeune B, Piette F et al. Burden of infections among 44 869 elderly in nursing homes : a cross-sectional cluster nationwide survey. J Hosp Infect 2011;79 :254-259.
83. Cotter M, Donlon S, Roche F, Byrne H, Fitzpatrick F. Healthcare-associated infection in Irish long-term care facilities: results from the first national prevalence. J Hosp Infect 2012;80:212-216.
84. Health Protection Scotland. Healthcare Associated infections in European long terma care facilities. Prevalence study 2010. http://www.documents.hps.. scot.nhs.uk/hai/sshaip/publications/halt/halt-prevalence-2010.pdf
85. Eilers R, Veldman-Ariesen MJ, Haenen A, van Benthem BH. Prevalence and determinants associated with healthcare-associated infections in long-term care facilities (HALT) in the Netherlands, May to June 2010. Eurosurveillance 2012;17(34):pii=20252
86. Heudorf U, Boehlcke K, Schade M. Healthcare-associated infections in long-term care facilities (HALT) in Frankfurt am Main, Germany, January to March 2011. Eurosurveillance 2012;17(359:pii=20256
87. Marchi M, Grilli E, Mongardi M, Bedosti C, Nobilio L, Moro ML. Prevalence of infections in long-term care facilities: how to read it? Infection 2012;40:493-500.
88. Lyytikainen O, Kanerva M, Agthe N, Möttönen T, Ruutu P. Healthcare-associated infections in Finnish acute care hospitals: a national prevalence survey, 2005. J Hosp Infect 2008;69:288-294.
89. Mylotte JM. Antimicrobial prescribing in long-term care facilities: prospective evaluation of antimicrobial use and cost indicators. Am J Infect Control 1999;27:10-19.
90. Stevenson KB, Moore J, Colwell H, Sleeper B. Standardized infection surveillance in long-term care: interfacility comparisons from a regional cohort facilities. Infect Control Hosp Epidemiol 2005;26:231-238.
91. Brusaferro S, Regattin L, Silvestro A, Vidotto L. Incidence of hospital-acquired infections inItalian long-term care facilities: a prospective six-month surveillance. J Hosp Infect 2006;63:211-215.
92. Mylotte JM, Keagle J. Benchmarks for antibiotic use and cost in long-term care. J Am Geriatr Soc 2005;53:1117-1122.
93. Pettersson E, Vernby Å, Mölstad S, Stålsby C. Infections and antibiotic prescribing in Swedish nursing homes: A cross-sectionala study. Scan J Infect Dis 2008;40:393-98
94. Eriksen HM, Koch AM, Elstrøm, Nilsen RM, Harthug S, Aavitsland P. Healthcare-associated infection among residents of long-term care facilities: a cohort and nested case-control study. J Hosp Infect 2007;65:334-340.
95. Schulz M, Mielke M, Wischnewski N. Clusters of infectious diseases in German nursing homes – observations from a prospective infection surveillance study, October 2008 to August 2009.Euro Surveill 2011;16(22):pii=19881.
96. Klevens MR, Edwards JR, Richards CL Jr, Horan TC, Gaynes RP, Pollock DA et al. Estimating Health care-associated infections and deaths in U.S. hospitals, 2002. Public Health Rep 2007;122:160-166.
97. Blix HS, Bergman J, Schjøtt J. How are antibacterials used in nursing homes ? Results from a point-prevalence prescription study in 44 Norwegian nursing homes.. Pharmacoepidemiol Drug Saf 2010 ;19 :1025-1030.
98. Daneman N, Gruneir A, Newman A, Fischer HD, Bronskill SE, Rochon PA et al. Antibiotic use in long-term care facilities. J Antimicrob Chemother 2011 ;66 :2856-2863

99. Warren JW,Palumbo FB, Fitterman L, Speedle SM. Incidence and characteristics of antibiotic use in aged nursing home patients. J Am Geriatr Soc 1991;39:963-72.
100. McClean P, Tunney M, Gilpin D, Parsons C, Hughes C. Antimicrobial prescribing in nursing homes in Northern Ireland. Drugs Aging 2011;28:819-829.
101. Loeb MB, Craven S, McGeer AJ, Simor AE, Bradley SF, Low DE et al. Risk factors for resistance to antimicrobial agents among nursing home residents. Am J Epidemiol 2003;157:40-47.
102. Benoit SR, Nsa W, Richards CL, Bratzler DW, Shefer AM, Steele LM, Jernigan JA. Factors associated with antimicrobial use in nursing homes: A multilevel mode. J Am Geriatr Soc 2008;56:2039-44.
103. Pettersson E, Vernby Å, Mölstad S, Stålsby C. Infections and antibiotic prescribing in Swedish nursing homes: A cross-sectionala study. Scan J Infect Dis 2008;40:393-98
104. Blix HS, Røed J, Oddrun Sti M. Large variation in antibacterial use among Norwegian nursing homes. Scan J Infect Dis 2007;39:536-541
105. Fagan M, Mæhlen M, Lindbæk M, Berild D. Antibiotic prescribing in nursing homes in an area with low prevalence of antibiotic resistance: compliance with national guidelines. Scan J Prim Health Care 2012;30:10-15.
106. Puhto T, Ylipalosaari P, Ohtonen P, Syrjälä H. Point prevalence and risk factors for healthcare-associated infections in primary healthcare wards. Infection:2011;39:217-223.
107. Polk RE, Hohmann SF, Medvedev S, Ibrahim O. Benchmarking risk-adjusted adult antibacterial drug use in 70 US academic medical center hospitals. Clin Infect Dis 2011;53:1100-1110.
108. Koch AM, Eriksen HM, Elstrøm P, Aavitsland P, Harthug S. Severe consequences of healthcare-associated infections among residents of nursing homes: a cohort study. J Hosp Infect 2009;71:269-274
109. Jump RLP, Olds DM, Seifi N, Kypriotakis G, Jury LA, Peron EP, Hirsch AA, Drawz PE et al Effective antimicrobial stewardship in a long-term care facility through an infectious disease consultation service: Keeping a LID on antibiotic use. Infect Control Hosp Epidemiol 2012;33:1185-92
110. Pettersson E, Vernby Å, Mölstad S, Stålsby Lundborg C. Can multifaceted educational intervention targeting both nurses and physicians change the prescribing of antibiotics to nursing home residents? A cluster randomized controlled trial. J Antimicrob Chemother 2011;66:2659-2666.
111. Monette J, Miller MA, Monette M, Laurier C, Boivin J-F, Sourial N et al. Effect of an educational intervention on optimizing antibiotic prescribing in long-term care facilities. J Am Geriatr Soc 2007;55:1231-1235.
112. Zabarsky TF, Sethi AK, Donskey CJ. Sustained reduction in inappropriate treatment of asymptomatic bacteriuria in a long-term care facility through an educational intervention. Am J Infect Control 2008;36:476-80
113. Schwartz DN, Abiad H, DeMarais PL, Armeanu E, Trick WE, Wang Y et al. An Educational intervention to improve antimicrobial use in a hospital-based long-term care facility. J Am Geriatr Soc 2007;55:1236-1242.
114. Hand Hygiene in Outpatient and home-based care and Long-term Care Facilities. WHO 2012. http://www.who.int/gpsc/5may/hh_guide.pdf
115. Magiorakos AP, Suetens C, Boyd L, Costa C, Cunney R, Drouvot V et al. National hand hygiene campaigns in Europe, 2000-2009. **Euro Surveill.2009;14(17):pii=19190.**
116. Magiorakos AP, Leens E, Drouvot V, May-Michelangeli I, Reichardt C, Gastmeier P *et al*. Pathways to clean hands: highlights of successful hand hygiene implementation strategies in Europe. *Euro Surveill* 2010;**15(**18);pii=19560.

117. Kacelnik O, Førland OJ, Iversen B. Evaluation of the national campaign to improve hand hygiene in nursing homes in Norway. J Hosp Infect 2011;77:359-360.
118. Pittet D, Simon A, Hugonnet S, Pessoa-Silva C, Sauvan V, Perneger V. Hand hygiene among physicians: performance, beliefs and perceptions. *Ann Intern Med* 2004;**141**:1-8.
119. Vayalumkal JV, Quellet C, Roth VR. Access to hand hygiene in eastern Ontario *The Can J Infect Control* 2009:153-157.
120. Smith A, Carusone SC, Loeb M. Hand hygiene practices of health care workers in long-term care facilities. *Am J Infect Control* 2008; **36**:492-4.
121. Pan A, Domenighini F, Signorini L, Assini R, Catenazzi P, Lorenzotti S *et al*. Adherence to hand hygiene in an Italian long-term care facility. *Am J Infect Control* 2008; **36**:495-7.
122. Eveillard M, Joly-Guillou M-L, Brunel P. Correlation between glove use practices and compliance with hand hygiene in a multicenter study with elderly patients. Am J Infect Control 2012;40:387-8.
123. Eveillard M, Pradelle M-T, Lefrancq B, Guilloteau V, Rabjeau A, Kempf M, Vidalenc O et al Measurement of hand hygiene compliance and gloving practices in different settings for the elderly considering the location of hand hygiene opportunities during patient care. Am J Infect Control 2011;39:339-41.
124. Huang T-T, Wu SC. Evaluation of a training programme on knowledge and compliance of nurse assistants' hand hygiene in nursing homes. J Hosp Infection 2008;68:164-170.
125. Yeung WK, Tam WSW, Wong TW. Clustered randomized controlled trial of a hand hygiene intervention involving pocket-sized containers of alcohol-based hand rub for the control of infections in long-term care facilities. Infect Control Hosp Epidemiol 2011;**32**:67-76.
126. Makris TA, Morgan L, Gaber D, Richter A, Rubino JR. Effect of a comprehensive infection control program on the incidence of infections in long-term care facilities. A J Infect Control 2000;28:3-7.
127. Schweon SJ, Edmonds SL, Kirk J, Rowland DY, Acosta C. Effectiveness of a comprehensive hand hygiene program for reduction of infection rates in a long-term care facility. Am J Infect Control 2012 epub doi:10.1016/j.ajic2012.02.010.
128. Ho ML, Seto WH, Wong LC, Wong TY. Effectiveness of multifaceted hand hygiene interventions in long-term care facilities in Hong Kong: A cluster-randomized controlled trial. Infect Control Hosp Epidemiol 2012:33:761-67.
129. Simonsen L, Taylor RJ, Viboud C, Miller MA, Jackson LA. Mortality benefits of influenza vaccination in elderly people: an ongoing controversy. Lancet Infect Dis 2007;7:658-66.
130. Govaert TM, Thijs CT, Masurel N, Spenger MJ, Dinant DJ, Knottnerus JA, The efficacy of influenza vaccination in elderly individuals. A randomized doublr-blind placebo-controlled trial. JAMA 1994;272:1661-65.
131. Jefferson T, Di Pietrantoni C, AL-Ansary LA, Ferroni E, Thorning S, Thomas RE. Vaccines for preventing influenza in the elderly. Cochrane Database of Systematic Reviews 2010, Issue 2.
132. Osterholm MT, Kelley NS, Sommer A, Belongia EA. Efficacy and effectiveness of influenza vaccines: a systematic review and meta-analysis. Lancet Infect Dis 2012;12:36-44.
133. Simonsen L, Reichert TA, Vibound C, Blackwelder WC, Taylor RJ, Miller MA. Impact of influenza vaccinations on seasonal mortality in the US elderly population. Arch Intern Med 2005;165:265-272.
134. Dolan GP, Harris RC, Clarkson M, Sokal R, Morgan G, Mukaigawara M, Horiuchi H et al. Vaccination of health care workers to protect patients at increased risk fot acute respiratory disease. Emerg Infect Dis 2012;18:1225-34.
135. Thomas RE, Jefferson TO, Demicheli D, Rivetti D. Influenza vaccination for health-care workers

who work with elderly people in institutions: a systematic review. Lancet Infect dis 2006; 6; 273-9.

136. Thomas RE, Jefferson T, Lasserson TJ. Influenza vaccination for healthcare workers who work with the elderly. Cochrane Systematic Reviews 2010, Issue 2.

137. Spindler C, Hedlund J, Jasir A, Normark BH, Örtqvist Å. Effects of a large-scale introduction of the pneumococcal polysaccharide vaccine among elderly persons in Stockholm, Sweden. Vaccine 2008;26:5541-5546.

138. Moberley S, Holden J, Tatham DP, Andrews RM. Vaccines for preventing pneumococcal infection in adults. Cochrane Database of Systematic Reviews 2013. Issue 1.

139. Improving Patient Safety in Europe (IPSE) Report 2005-2008. 2009 www.ecdc.eu.

140. Kärki T, Ruutu P, Lyytikäinen O. Infection control In Finnish acute care hospitals 2008. Int J Infect Control 2011, v7:i4 doi:10.3396/ijic.V7i4.030.11.

141. Ohje meticilliiniresistenttien *Staphylococcus aureusten* torjunnasta. 2004 KTL

142. Current care Urinary tract infections 2011 Duodecim.

143. Clostridium difficile -infektioiden torjunta – slide set. 2008 KTL

144. Kuusi M, Kanerva M, Lyytikäinen O. Toimenpideohje Norovirus tartuntojen ehkäisemiseksi.2007. KTL.

145. Lyytikäinen O, Valle SL, Rostila T, Mansner R, Karppinen O, Seger M, Reunala T. Syyhyepidemia vanhusten hoitolaitoksessa. Suom Lääkäril 2002;57:2015-2020.

146. Suomen sairaalahygieniayhdistys www.sshy.fi

147. Kotilainen P, Routamaa M, Peltonen R, Evesti P, Eerola E, Salmenlinna S, Vuopio-Varkila J, Rossi T. Eradication of Meticillin-Resistant *Staphylococcus aureus* from a health center ward and associated nursing home. Arch Intern Med 2001;161:859-863.

148. Kotilainen P, Routamaa M, Peltonen R, Oksi J, Rintala E, Meurman O, Lehtonen O-P et al. Elimination of epidrmic meticillin resistant *Staphylococcus aureus* from a University hospital and district intitutions, Finland. Emerg Infect Dis 2003;9:169-75.

149. Kerttula A-M, Lyytikäinen O, Vuopio-Varkila J, Ibrahem S, Agthe N, Broas M, Jägerroos H, Virolainen A. Molecular epidemiology of an outbreak caused by Methicillin-Resistant *Staphylococcus aureus* in a health care ward and associated nursing home. J Clin Microbiol 2005;43:6161-6163.

150. Kerttula A-M, Lyytikäinen O, Virolainen A, Finne-Soveri H, Agthe N, Vuopio-Varkila J. *Staphylococcus aureus* colonization among nursing home residents in a large Finnish nursing home. Scan J Infect Dis 2007;39:996-1001.

151. www.valvira.fi.

152. www.finlex.fi. 22.7.2011/922.

153. Noro A, Finne-Soveri H, Björkgren M, Häkkinen U, Laine J, Välikangas P et al. RAI-tietojärjestelmän käyttöönotto ja pitkäaikaishoidon benchmarking: RAI RAPORTTI 1/2000. http://urn.fi/URN:NBN:fi-fe201204194012

154. Hawes C, Morris JN, Phillips CD, Mor V, Fries BE, Nonemaker S. Reliability estimates for the minimum data set for nursing home resident assessment and care screening (MDS). Gerontologist. 1995;35:172-8.

155. Onder G,Carpenter I, Finne-Soveri H, Gindin J,Frijters D, Henrard JC et al. Assessment of nursing home residents in Europe: the Services and Health for Elderly in Long TERm care (SHELTER) study. BMC Health Serv Res 2012;12:5.

156. Zimmerman DR, Karon SL, Arling G, Clark BR, Collins T, Ross R et al. Development and testing of nursing home quality indicators. Health Care Financ Rev. 1995 Summer;16:107-27.

157. Morris JN, Fries BE, Mehr DR, Hawes C, Phillips C, Mor V et al. MDS cognitive performance scale. J Gerontol. 1994;49:M174-82.
158. Dosa D, Intrator O, McNicoll L, Cang Y, Teno J. Preliminary derivation of a nursing home confusion assessment method based on data from the minimum data set. J Am Geriatr Soc. 2007;55:1099-105.
159. Larsen K, Merlo J. Appropriate assessment of neighborhood effects on individual health: Integrating random and fixed effects in multilevel logistic regression. Am J Epidemiol 2005;161:81-88.
160. Larsen K, Holm Petersen J, Budtz-Jørgensen E *et al*. Interpreting parameters in the logistic regression model with random effects. Biometrics 2000;56:909-914.
161. Merlo J, Chaix B, Ohlsson H *et al*. A brief conceptual tutorial of multilevel analysis in social epidemiology: using measures of clustering in multilevel logistic regression to investigate contextual phenomena. J Epidemiol Community Health 2006;60:290–297. doi: 10.1136/jech.2004.029454.
162. Finnish Statistics on Medicines 2010. Finnish medicines Agency Fimea and Social Insurance Institution. Helsinki 2011
163. Lee BS, Bhuta T, Simpson JM, Craig JC. Methenamine hippurate for preventing urinary tract infections. Cochrane Database Syst Rev 2012; doi 10.1002/14651858.CD003265.pub3.
164. Jepson RG, Williams G, Craig JC. Cranberries for preventing urinary tract infections. The Cochrane Database Syst Rev 2012, DOI:10.1002/14651858.CD001321.pub5.
165. Fick DM, Cooper JW, Wade WE, Waller JL, Maclean JR, Beers MH. Updating the Beers criteria for potentially inappropriate medication use in older adults. Arch Intern Med 2003;163:2716-2724.
166. Rummukainen M, Karppi P. Recommendation for antimicrobial use in long-term care in Central Finland Healthcare District (in Finnish). Finnish Med J 2006;61:4337-49.
167. HSE-Health Protection Surveillance Centre. Diagnosis & Management of Urinary Tract Infection in Long Term Care Residents > 65 years. Dublin:HPSC; 2011. Available from:http://www.hpsc.ie/hpsc/AZ/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/Guidelines/File,12929,en.pdf
168. National Institute for Public Health and the Environment (RIVM), the Netherlands www.RIVM.nl
169. Elintarviketurvallisuusvirasto Evira Ruokamyrkytysten raportointi RYMY. www.evira.fi.
170. Finnish Study Group for Antimicrobial Resistance FiRe www.finres.fi.
171. European Antimicrobial Resistance Surveillance Network (EARS-Net) http://ecdc.europa.eu/en/activities/surveillance/EARS-Net
172. Dawson SJ. The role of the infection control link nurse. J Hosp Infect 2003;54:251-257.
173. Kärki T, Meriö-Hietaniemi I, Möttönen T, Ruutu P, Lyytikäinen O. Prevention of healthcare associated infections requires continuous effort. Finnish Medical Journal 2010;65:3036-3041.

10. Appendix

Appendix 1
KESKISUOMALAISTEN LAITOSTEN HYGIENIAKARTOITUS

1. Laitoksen numero _____

LAITOS:_____

2. Selvityksen päivämäärä _____

3. Laitoksen laatu

1 terveyskeskuksen vuodeosasto
2 vanhainkoti
3 dementiayksikkö
4 palvelukoti
5 psykiatrinen sairaala
6 muu

4.. Osasto: _____

5. Paikkakunta: _____ (kuntakoodi)

6. Pitkäaikaishoidossa olevien määrä (yli 3 kk)

1 naiset _____

2 miehet _____

7. Lyhytaikaishoidossa olevien määrä (alle 3 kk)

1 naiset _____

2 miehet _____

8. Keski-ikä _____ (täysiä vuosia)

9. Yli 65-vuotiaiden osuus :_____ (%)

10. Mitä toimintakykymittareita on käytössä?

1 Vasa
2 RaVa
3 Barthel
4 RAI
5 mielialamittari: Mikä _____
6 MMSE
7 CERAD
8 jokin muu, mikä: _____

11. Diagnoosijakauma (%)

1 AVH _____
2 dementia _____
3 psykiatrisesti oireilevia _____
4 muu _____

12. Hoitohenkilökunnan määrä

1 sairaanhoitaja _____
2 perus/lähihoitaja_____
3 laitos/osasto/hoitoapulainen _____
4 muut _____

13. Lääkärin työpanos tuntia/viikko _____ (0,25 h:n tarkkuus)

14. Moniko potilas / asukas käy itse WC:ssä? _____

15. Moniko käy WC:ssä avustettuna? _____

16. Moniko käyttää vaippaa? _____

17. Käsihuuhteen kulutus kuukaudessa _____ (litraa)

18. Käsihuuhdetta

1 joka potilashuoneessa

2 sisääntuloaulassa helposti saatavilla

3 hoitajien kansliassa helposti saatavilla

19. Mikrobilääkkeet. Mitä mikrobilääkkeitä löytyy lääkekaapista (ei metenamiinia)?

1 amoksisilliini
2 amoksisilliini-klavulaanihappo
3 doksisykliini
4 G-penisilliini
5 kefaleksiini
6 keftriaksoni
7 kefuroksiimi
8 kloksasilliini
9 metronidatsoli
10 nitrofurantoiini
11 norfloksasiini
12 pivmesillinaami
13 prokaiinipenisilliini
14 roksitromysiini tai muu makrolidi
15 siprofloksasiini
16 sulfa-trimetopriimi
17 trimetopriimi
18 V-penisilliini
19 muut, mitkä

_____

_____

20. Monellako asukkaalla on juuri nyt mikrobilääkitys (muu kuin metenamiini)?

1 virtsatietulehduksen hoitoon _____
2 virtsatietulehdusten estohoitoon _____
3 ihoinfektioihin, haavatulehduksiin _____
4 hengitystieinfektioihin _____
5 muihin tarkoituksiin, mihin? _____

21. Paljonko mikrobilääkkeitä käytetään vuodessa?

1 eurot _____
2 DDD _____
3 ei tiedossa

22. Milloin otetaan virtsaviljely? Kun

1 paikallisoireet
2 yleisoireet
3 haju
4 muu mikä: _____

23. Mitä tutkimuksia käytetään?

1 osastolla tehdään moniliuskakoe
2 virtsan mikroskooppinen tutkimus
3 virtsan bakteeriviljely
4 virtsan mikroskooppinen tutkimus ja bakteeriviljely

24. Millä lääkkeellä hoidetaan (kolme yleisintä)?

1 amoksisilliini
2 nitrofurantoiini
3 pivmesillinaami
4 sulfa-trimetopriimi
5 trimetopriimi
7 muu, mikä: _____

25. Otetaanko virtsan bakteeriviljely hoidon päätyttyä?

1 kyllä
2 ei

26. Kuinka kauan lääkitys kestää yleensä

1 alle 5 vrk
2 5-7 vrk
3 yli 7 vrk

27. Montako kestokatetria tällä hetkellä? _____

28. Monellako potilaalla kerta- ja toistokatetrointia? _____

29. Montako cystofixiä? _____

30. Käytetäänkö VTI-estolääkitystä?

1 kyllä
2 ei

31. Virtsatietulehdusten ehkäisyyn käytetään

1 C-vitamiinia
2 estrogeeniä
3 karpalomehua/tabletteja
4 metenamiinihippuraattia
5 nitrofurantoiinia
6 pivmesillinaamia
7 trimetopriimia
8 muuta, mitä _____

32. Käytetäänkö kestokatetrin ja / tai cystofixin kanssa estolääkitystä?

1 kyllä
2 ei

33. Montako haavapotilasta on juuri nyt? _____

34. Millaisia haavoja (eri potilaita) juuri nyt?

1 leikkaushaava
2 painehaava
3 säärihaava
4 diabeetikon haava

5 muita, mitä: _____
6 ei haavoja

35. Milloin otetaan haavasta bakteeriviljely?

1 joka haavasta
2 oireiden mukaan (punotus, turvotus, eritys, kipu)
3 aina kun leikkaushaava erittää
4 muu syy, mikä: _____
5 ei yleensä oteta

36. Paikallishoidossa käytetyt aineet, 3 tavallisinta

1 _____
2 _____
3 _____

37. Onko laitoksessa haavanhoitokoulutuksen saaneita henkilöitä?

1 kyllä
2 ei

38. Kuka (ammattinimike) hoitaa haavat?

1 sairaanhoitaja
2 perushoitaja / lähihoitaja
3 hoitoapulainen / laitosapulainen / osastoapulainen

39. Kuinka monta vuorokautta yleensä annetaan erysipelakseen (ruusun) mikrobilääkehoitoa?

1 alle 7 vrk
2 7-14 vrk
3 15-21 vrk
4 yli 21 vrk

40. Onko laitoksessa todettu/hoidettu syyhypotilaita viimeisen vuoden aikana?

1 kyllä
2 ei

41. Hoidetaanko / hoidettaisiinko vyöruusua mikrobilääkkeillä?

1 kyllä
2 ei

42. Moneltako potilaalta / asukkaalta tutkittiin viimeisen kuukauden aikana CRP?
_____

43. Millä mikrobilääkkeellä yleensä hoidetaan hengitystieinfektioita?

1 amoksisilliini
2 doksisykliini
3 G-penisilliini
4 kefaleksiini
5 kefuroksiimi
6 makrolidi
7 V-penisilliini
8 muu, mikä: _____

44. Kuinka pitkä on yleensä niiden hoitoaika? _____ vrk

45. Onko laitoksessa toteutettu laskimonsisäistä lääkehoitoa?

1 kyllä
2 ei

46. Montako thorax-kuvaa on otettu viimeisen kuukauden aikana? _____

47. Moneltako potilaalta on viimeisen vuoden aikana otettu ysköksen tubinäytteitä?
_____

48. Onko desinfioiva huuhtelulaite (Deko)?

1 kyllä
2 ei

49. Huolletaanko se kerran vuodessa tai useammin?

1 kyllä
2 ei

50. Kuka tarkkailee koneen toimintaa, vastuuhenkilö?

1 sairaanhoitaja
2 perushoitaja / lähihoitaja
3 laitostosapulainen / hoitoapulainen / osastoapulainen
4 muu
5 ei tietoa, ei kukaan

51. Missä sterilointia tarvitsevat välineet huolletaan?

1 itse
2 terveyskeskus
3 keskussairaalan / erikoissairaanhoidon välinehuolto
4 muu, mikä _____
5 ei tarvita

52. Montako MRSA-potilasta laitoksessa on tällä hetkellä? _____

53. Montako MRSA- potilasta on ollut viimeisen vuoden aikana? _____

54. Montako ESBL-potilasta laitoksessa on nyt? _____

55. Montako ESBL-potilasta laitoksessa on ollut vuoden aikana? _____

56. Onko laitoksessa viimeisen vuoden aikana hoidettu Cl. difficile -ripulia?

1 kyllä
2 ei

57. Asiakkaiden huoneet (= montako potilasta huoneessa tällä hetkellä)

1 yhden hengen huoneet
2 kahden hengen huoneet
3 kolmen hengen huoneet
4 neljän hengen huoneet
5 vielä useampi henkilö samassa huoneessa

58. Montako huonetta on, joissa oma WC ja suihku? _____

59. Montako huonetta on, joissa on yhteinen WC toisen huoneen kanssa? _____

60. Montako huonetta, joissa ei ole WC:tä ? _____

61. Montako WC:tä käytävän varrella? _____

62. Montako kylpyhuonetta käytävän varrella? _____

63. Tarjotaanko kaikille potilaille / asukkaille influenssarokotetta?

1 kaikille asukkaille
2 vain osalle
3 ei kenellekään

64. Pneumokokki-rokote

1 kaikille
2 vain osalle
3 ei kenellekään

65. Rokotetaanko henkilökuntaa influenssarokotteella

1 kyllä
2 ei

Haastatteluun ja selvitykseen kului aikaa _____ (min)

Mukana olivat: _____
_____
_____
_____
_____
_____
_____

Erityistä huomioitavaa: _____

_____

_____

Täyttöohje hygieniakartoituslomakkeeseen 3.10.2006

(Kohdat 1-3 on täytetty valmiiksi.)

Kohta 4: Merkitään kartoituspäivänä klo 8 pitkäaikaishoidossa olleiden naisten ja miesten lukumäärät. (Jollei ole yhtään, merkitään 0.)
Tähän merkitään myös palvelutalojen ja dementiayksikköjen vakituisten asukkaiden määrät.

Kohta 5: Tähän merkitään terveyskeskussairaaloiden ja vanhainkotien lyhytaikais-, akuutti- ja kriisihoidossa olleiden lukumäärä klo 8.
Tähän kirjataan myös palvelutalojen ja dementiayksikköjen lyhytaikais- ja vuorohoitoasukkaat.

Kohta 6: Merkitään käsihuuhteen käyttö litroina syyskuun 2006 aikana (desilitran tarkkuudella, syyskuun sijasta käy se vuoden 2006 viimeinen kuukausi, jonka käyttömäärä on tiedossa).

Kohta 7: Merkitään kullekin riville klo 8 tilanne eli niiden henkilöiden lukumäärät, jotka saivat antibioottia esitettyjen syiden takia. (ei yhtään = 0, puuttuminen merkitään näin myös myöhemmissä kysymyksissä)
Muihin tarkoituksiin (rivi 5) käytettyjen kuurien syyt voi selvittää suluissa varattuun tilaan ja sivun alalaitaan.

Kohta 8: Metenamiinihippuraatti (Hipeksal, Hiprex) ei ole varsinainen mikrobilääke. Tässä ilmoitetaan sitä käyttävien henkilöiden lukumäärä klo 8 tilanteen mukaan (ei kohtaan 7!).

Kohta 9: Rengastetaan oikea vaihtoehto (joko 1 tai 2).

Kohta 10: Kestokatetria klo 8 käyttäneiden lukumäärä.

Kohta 11: Säännöllistä kerta- ja toistokatetrointia käyttävien yhteismäärä.

Kohta 12: Cystofixiä käyttävien määrä klo 8.

Kohta 13: MRSA-potilaiden ja -kantajien kokonaislukumäärä klo 8 (=kaikki ne joilla on joskus ollut positiivinen bakteeriviljely)

Kohta 14: ESBL-kantajien määrä. Nämä bakteerit ovat yleensä E. coli tai Klebsiella -kantoja. Näiden bakteeriviljelytuloksen perään on merkitty, että pitää ottaa yhteyttä infektiolääkäriin.

Kohta 15: Ilmoitetaan syksyn 2006 suunnitelma. Rengastetaan oikea vaihtoehto (1,2 tai 3).

Kohta 16: Ilmoitetaan, onko hoidettaville annettu pneumokokkirokotuksia. Valitaan oikea vaihtoehto (1, 2 tai 3), joka rengastetaan.

Kohta 17: Valitaan oikea vaihtoehto rengastamalla 1 tai 2.

Kohta 18: Arvioidaan influenssarokotteen ottajien osuus henkilökunnasta ja merkitään arvio kokonaisina prosentteina tyhjälle viivalle.

Kohta 19: Täytetään rengastamalla yksi tai useampi aihe, josta halutaan koulutusta. Vaihtoehtoihin 11 ja 12 voi kirjoittaa omia toiveita koulutuksen aiheiksi.

Kohta "Muuta tärkeää"
on varattu mahdollisille lisätiedoille ja kommenteille.

Hoidettavien nimiä tai henkilötunnuksia ei tule listoihin.

Lomakkeen täytöstä vastaa hoitoyksikön johtaja, osastonhoitaja tai vastaava.

Huolellisesti täytetyt lomakkeet lähetetään viimeistään 10.10.2006 palautuskuoressa. Postimaksu on valmiiksi maksettu.

Lisäohjeita voi saada soittamalla hygieniahoitaja Aino Jakobssonille,
p. (014) 269 1578 arkisin klo 8-15.

KIITOKSET VASTAUKSISTANNE!

Keski-Suomen sairaanhoitopiiri
Infektio- ja sairaalahygienian yksikkö
Geriatrian yksikkö

Kirje

11.9.2006

Jakelussa mainituille

Asia: **Keskisuomalaisten hoitopaikkojen hygieniakartoitus 3.10.2006**

Infektiolääkäri, hygieniahoitaja ja geriatri tekivät hygieniakartoituksen vierailemalla kussakin hoitopaikassa vuosien 2004 ja 2005 aikana. Kiitämme siitä, että saimme tulla luoksenne ja tutustua tiloihinne ja toimintaanne.

Nykytilanteen kartoittamiseksi tehdään **3.10.2006** kaikissa aikaisemmin kartoitetuissa yksiköissä kirjekyselynä seurantaselvitys. Hoidettavien osalta halutaan saada tieto juuri kartoituspäivältä, kello 8 aamulla vallinneesta tilanteesta.

Kyselylomakkeet tulee lähettää palautuskuoressa (postimaksu maksettu) viimeistään 10.10.2006.

Lisätietoja antaa hygieniahoitaja Aino Jakobsson, puh. (014) 269 1578.

Kiitollisin yhteistyöterveisin

Maija Rummukainen
Osatonylilääkäri, infektiolääkäri

Aino Jakobsson
Hygieniahoitaja

Pertti Karppi
Geriatrian ylilääkäri

LIITTEET Kyselylomake ja täyttöohje

KESKISUOMALAISTEN HOITOPAIKKOJEN HYGIENIAKARTOITUS 3.10.2006

1. Yksikön numero _____

   Yksikkö:_____

2. Osasto: _____

3. Paikkakunta: _____ (kuntakoodi)

Täyttäkää seuraavat kohdat 3.10.2006 klo 8.00 vallinneen tilanteen mukaan.

4. Pitkäaikaishoidossa olevien määrä (yli 3 kk)

1 naiset _____

2 miehet _____

5. Lyhytaikaishoidossa olevien määrä (alle 3 kk)

1 naiset _____

2 miehet _____

6. Käsihuuhteen kulutus kuukaudessa _____ (litraa, yksi desimaali saa olla)

7. Monellako potilaalla / asukkaalla on tänään mikrobilääkitys? Ei tarkoiteta metenamiinia (Hipeksal, Hiprex) eikä paikallishoitoja.

1 virtsatietulehduksen hoitoon _____

2 virtsatietulehdusten estohoitoon _____

3 ihoinfektiohin, haavatulehduksiin _____

4 hengitystietulehduksiin _____

5 muihin tarkoituksiin _____

(Mihin: _____)

8. Kuinka monella potilaalla / asukkaalla on käytössä metenamiinihippuraatti (Hipeksal, Hiprex)?

_____

9. Onko käytössänne desinfioiva huuhtelulaite (esim. Deko)?

1 kyllä
2 ei

10. Kuinka monta kestokatetria on tällä hetkellä? _____

11. Kuinka monella potilaalla / asukkaalla on säännöllistä kerta- tai toistokatetrointia? ____

12. Kuinka monta Cystofixiä on käytössä? _____

13. Montako MRSA-potilasta on tällä hetkellä hoidossa? _____

14. Montako ESBL-potilasta on tällä hetkellä hoidossa? _____

15. Tarjotaanko tänä syksynä potilaille / asukkaille influenssarokotetta?

1 kaikille
2 vain osalle
3 ei kenellekään

16. Onko potilaita / asukkaita rokotettu 5 vuoden aikana pneumokokki-rokotteella?

4 kaikkia
5 vain osaa
6 ei ketään

17. Tarjoaako työterveyshuolto tai työnantaja henkilökunnalle influenssarokotetta?

3 kyllä
4 ei

18. Kuinka suuri osa henkilöstöstä rokotetaan tänä syksynä influenssaa vastaan?

_____ %.

19. Mistä seuraavista aiheista henkilökunta haluaisi lisäkoulutusta?

1 käsihygienia
2 suojainten käyttö
3 työtavat (mm. Dekon käyttö, siivous, aseptinen työjärjestys)
4 neulojen ja terävien esineiden käyttö
5 MRSA- ja ESBL-potilaiden hoito
6 eristysperiaatteet
7 potilaiden ja henkilöstön rokotukset
8 bakteeritulehdusten diagnostiikka ja hoito
9 mikrobilääkkeiden käyttö
10 muu aihe, mikä: _____
11 muu aihe, mikä: _____
12 muu aihe, mikä: _____

Muuta tärkeää

Parhaat kiitokset vastauksistanne!

Täyttöohje hygieniakartoituslomakkeeseen 3.10.2007

(Kohdat 1-3 on täytetty valmiiksi.)

Kohta 4: Merkitään kartoituspäivänä klo 8 pitkäaikaishoidossa olleiden naisten ja miesten lukumäärät. (Jollei ole yhtään, merkitään 0.)
Tähän merkitään myös palvelutalojen ja dementiayksikköjen vakituisten asukkaiden määrät.

Kohta 5: Tähän merkitään terveyskeskussairaaloiden ja vanhainkotien lyhytaikais-, akuutti- ja kriisihoidossa olleiden lukumäärä klo 8.
Tähän kirjataan myös palvelutalojen ja dementiayksikköjen lyhytaikais- ja vuorohoitoasukkaat.

Kohta 6: Merkitään käsihuuhteen käyttö litroina syyskuun 2007 aikana (desilitran tarkkuudella, syyskuun sijasta käy se vuoden 2007 viimeinen kuukausi, jonka käyttömäärä on tiedossa).

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Muihin tarkoituksiin (rivi 5) käytettyjen kuurien syyt voi selvittää suluissa varattuun tilaan ja sivun alalaitaan.

Kohta 8: Metenamiinihippuraatti (Hipeksal, Hiprex) ei ole varsinainen mikrobilääke. Tässä ilmoitetaan sitä käyttävien henkilöiden lukumäärä klo 8 tilanteen mukaan (ei kohtaan 7!).

Kohta 9: Rengastetaan oikea vaihtoehto (joko 1 tai 2).

Kohta 10: Kestokatetria klo 8 käyttäneiden lukumäärä.

Kohta 11: Säännöllistä kerta- ja toistokatetrointia käyttävien yhteismäärä.

Kohta 12: Cystofixiä käyttävien määrä klo 8.

Kohta 13: MRSA-potilaiden ja -kantajien kokonaislukumäärä klo 8 (=kaikki ne joilla on joskus ollut positiivinen bakteeriviljely)

Kohta 14: ESBL-kantajien määrä. Nämä bakteerit ovat yleensä E. coli tai Klebsiella -kantoja. Näiden bakteeriviljelytuloksen perään on merkitty, että pitää ottaa yhteyttä infektiolääkäriin.

Kohta 15: Ilmoitetaan syksyn 2007 suunnitelma. Rengastetaan oikea vaihtoehto (1,2 tai 3).

Kohta 16: Ilmoitetaan, onko hoidettaville annettu pneumokokkirokotuksia. Valitaan oikea vaihtoehto (1, 2 tai 3), joka rengastetaan.

Kohta 17: Valitaan oikea vaihtoehto rengastamalla 1 tai 2.

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Kohta 19: Täytetään rengastamalla yksi tai useampi aihe, josta halutaan koulutusta. Vaihtoehtoihin 11 ja 12 voi kirjoittaa omia toiveita koulutuksen aiheiksi.

Kohta "Muuta tärkeää"
on varattu mahdollisille lisätiedoille ja kommenteille.

Hoidettavien nimiä tai henkilötunnuksia ei tule listoihin.

Lomakkeen täytöstä vastaa hoitoyksikön johtaja, osastonhoitaja tai vastaava.

Huolellisesti täytetyt lomakkeet lähetetään viimeistään 10.10.2007 palautuskuoressa. Postimaksu on valmiiksi maksettu.

Lisäohjeita voi saada soittamalla hygieniahoitaja Tiina Tiitiselle,
p. (014) 269 5578 arkisin klo 8-15.

KIITOKSET VASTAUKSISTANNE!

Keski-Suomen sairaanhoitopiiri
Infektio- ja sairaalahygienian yksikkö
Geriatrian yksikkö

Kirje

11.9.2007

Jakelussa mainituille

Asia: **Keskisuomalaisten hoitopaikkojen hygieniakartoitus 3.10.2007**

Infektiolääkäri, hygieniahoitaja ja geriatri tekivät hygieniakartoituksen vierailemalla kussakin hoitopaikassa vuosien 2004 ja 2005 aikana. Seurantakartoitus tehtiin **3.10.2006** kirjekyselynä.

Vastaava kysely toteutetaan taas 3.10.2007, ja siihen on saatu Keski-Suomen sairaanhoitopiirin eettisen toimikunnan lupa. Hoidettavien osalta halutaan saada tiedot juuri kartoituspäivältä, kello 8 aamulla vallinneesta tilanteesta.

Kyselylomakkeet tulee lähettää palautuskuoressa (postimaksu maksettu) viimeistään 10.10.2007.

Lisätietoja antaa hygieniahoitaja Tiina Tiitinen, puh. (014) 269 5578.

Kiitollisin yhteistyöterveisin

Maija Rummukainen
Osatonylilääkäri, infektiolääkäri

Tiina Tiitinen
Hygieniahoitaja

Pertti Karppi
Geriatrian ylilääkäri

LIITTEET

Kyselylomake ja täyttöohje

KESKISUOMALAISTEN HOITOPAIKKOJEN HYGIENIAKARTOITUS 3.10.2007

1. Yksikön numero _____

   Yksikkö:_____

2. Osasto: _____

3. Paikkakunta: _____ (kuntakoodi)

Täyttäkää seuraavat kohdat 3.10.2007 klo 8.00 vallinneen tilanteen mukaan.

4. Pitkäaikaishoidossa olevien määrä (yli 3 kk)

1 naiset _____

2 miehet _____

5. Lyhytaikaishoidossa olevien määrä (alle 3 kk)

1 naiset _____

2 miehet _____

6. Käsihuuhteen kulutus kuukaudessa _____ (litraa, yksi desimaali saa olla)

7. Monellako potilaalla / asukkaalla on tänään mikrobilääkitys? Ei tarkoiteta metenamiinia (Hipeksal, Hiprex) eikä paikallishoitoja.

1 virtsatietulehduksen hoitoon _____

2 virtsatietulehdusten estohoitoon _____

3 ihoinfektiohin, haavatulehduksiin _____

4 hengitystietulehduksiin _____

5 muihin tarkoituksiin _____

(Mihin: _____)

8. Kuinka monella potilaalla / asukkaalla on käytössä metenamiinihippuraatti (Hipeksal, Hiprex)?

_____

9. Onko käytössänne desinfioiva huuhtelulaite (esim. Deko)?

1 kyllä
2 ei

10. Kuinka monta kestokatetria on tällä hetkellä? _____

11. Kuinka monella potilaalla / asukkaalla on säännöllistä kerta- tai toistokatetrointia? ____

12. Kuinka monta Cystofixiä on käytössä? _____

13. Montako MRSA-potilasta on tällä hetkellä hoidossa? _____

14. Montako ESBL-potilasta on tällä hetkellä hoidossa? _____

15. Tarjotaanko tänä syksynä potilaille / asukkaille influenssarokotetta?

1 kaikille
2 vain osalle
3 ei kenellekään

16. Onko potilaita / asukkaita rokotettu 5 vuoden aikana pneumokokki-rokotteella?

1 kaikkia
2 vain osaa
3 ei ketään

17. Tarjoaako työterveyshuolto tai työnantaja henkilökunnalle influenssarokotetta?

1 kyllä
2 ei

18. Kuinka suuri osa henkilöstöstä rokotetaan tänä syksynä influenssaa vastaan?

_____ %.

19. Mistä seuraavista aiheista henkilökunta haluaisi lisäkoulutusta?

1 käsihygienia
2 suojainten käyttö
3 työtavat (mm. Dekon käyttö, siivous, aseptinen työjärjestys)
4 neulojen ja terävien esineiden käyttö
5 MRSA- ja ESBL-potilaiden hoito
6 eristysperiaatteet
7 potilaiden ja henkilöstön rokotukset
8 bakteeritulehdusten diagnostiikka ja hoito
9 mikrobilääkkeiden käyttö
10 muu aihe, mikä: _____
11 muu aihe, mikä: _____
12 muu aihe, mikä: _____

Muuta tärkeää

Parhaat kiitokset vastauksistanne!

Täyttöohje hygieniakartoituslomakkeeseen 3.10.2008

(Kohdat 1-3 on täytetty valmiiksi.)

Kohta 4: Merkitään kartoituspäivänä klo 8 pitkäaikaishoidossa olleiden naisten ja miesten lukumäärät. (Jollei ole yhtään, merkitään 0.)
Tähän merkitään myös palvelutalojen ja dementiayksikköjen vakituisten asukkaiden määrät.

Kohta 5: Tähän merkitään terveyskeskussairaaloiden ja vanhainkotien lyhytaikais-, akuutti- ja kriisihoidossa olleiden lukumäärä klo 8.
Tähän kirjataan myös palvelutalojen ja dementiayksikköjen lyhytaikais- ja vuorohoitoasukkaat.

Kohta 6: Merkitään käsihuuhteen käyttö litroina syyskuun 2008 aikana (desilitran tarkkuudella, syyskuun sijasta käy se vuoden 2008 viimeinen kuukausi, jonka käyttömäärä on tiedossa). Jos käsihuuhteen kulutusta ei ole seurattu, se lasketaan seuraavasti: selvitetään, kuinka paljon huuhdetta on käytetty viimeisen vuoden aikana ja saatu määrä jaetaan 12:lla (tai puolen vuoden kulutus ja saatu määrä jaetaan kuudella).

Kohta 7: Merkitään kullekin riville klo 8 tilanne eli niiden henkilöiden lukumäärä, jotka saivat antibioottia esitettyjen syiden takia. (ei yhtään = 0, puuttuminen merkitään näin myös myöhemmissä kysymyksissä).
Muihin tarkoituksiin (alakohta 5) käytettyjen kuurien syyt voi selvittää suluissa varattuun tilaan ja sivun alalaitaan.

Kohta 8: Metenamiinihippuraatti (Hipeksal, Hiprex) ei ole varsinainen mikrobilääke. Tässä ilmoitetaan sitä käyttävien henkilöiden lukumäärä klo 8 tilanteen mukaan (ei kohtaan 7!).

Kohta 9: Rengastetaan oikea vaihtoehto (joko 1 tai 2).

Kohta 10: Kestokatetria käyttävien määrä klo 8.

Kohta 11: Säännöllistä kerta- ja toistokatetrointia käyttävien yhteismäärä.

Kohta 12: Cystofixiä käyttävien määrä klo 8.

Kohta 13: MRSA -potilaiden ja -kantajien kokonaislukumäärä klo 8 (=kaikki ne joilla on joskus ollut positiivinen bakteeriviljely)

Kohta 14: ESBL -kantajien määrä. Nämä bakteerit ovat yleensä *E. coli* tai Klebsiella -kantoja. Näiden bakteeriviljelytuloksen perään on merkitty, että pitää ottaa yhteyttä infektiolääkäriin.

Kohta 15: Ilmoitetaan syksyn 2008 suunnitelma. Rengastetaan oikea vaihtoehto (1, 2 tai 3).

Kohta 16: Ilmoitetaan, onko hoidettaville annettu pneumokokkirokotuksia. Valitaan oikea vaihtoehto (1, 2 tai 3), joka rengastetaan.

Kohta 17: Valitaan oikea vaihtoehto rengastamalla 1 tai 2.

Kohta 18a: Arvioidaan niiden työntekijöiden kokonaislukumäärä, jotka ottavat influenssarokotteen.

Kohta 18b: Merkitään hoitopaikan koko henkilökunnan määrä (koskee sitä yksikköä, josta ilmoitatte hoidettavien määrän kohdissa 4-5).

Kohta 19: Täytetään rengastamalla yksi tai useampi aihe, josta halutaan koulutusta. Vaihtoehtoihin 10 - 12 voi kirjoittaa omia toiveita koulutuksen aiheiksi.

Kohta 20: Tässä ilmoitetaan niiden *Clostridium difficile* -positiivisten potilaiden /asukkaiden määrä, joita tutkimuspäivänä hoidetaan kosketuseristyksessä

Kohta 21: Merkitään lomakkeen täyttäjän nimi ja puhelinnumero, josta hän on tavoitettavissa mahdollista myöhempää yhteydenottoa varten.

Kohta "Muuta tärkeää"
on varattu mahdollisille lisätiedoille ja kommenteille.

Hoidettavien nimiä tai henkilötunnuksia ei tule listoihin.

Lomakkeen täytöstä vastaa hoitoyksikön johtaja, osastonhoitaja tai vastaava.

Huolellisesti täytetyt lomakkeet lähetetään viimeistään 10.10.2008 palautuskuoressa. Postimaksu on valmiiksi maksettu.

Lisäohjeita voi saada soittamalla hygieniahoitaja Maire Liikalle,
p. (014) 269 1580 arkisin klo 8-15.

KIITOKSET VASTAUKSISTANNE!

Keski-Suomen sairaanhoitopiiri
Infektio- ja sairaalahygienian yksikkö
Geriatrian yksikkö

Kirje

11.9.2008

Jakelussa mainituille

Asia: **Keskisuomalaisten hoitopaikkojen hygieniakartoitus 3.10.2008**

Infektiolääkäri, hygieniahoitaja ja geriatri tekivät hygieniakartoituksen vierailemalla kussakin hoitopaikassa vuosien 2004 ja 2005 aikana. Seurantakartoitukset tehtiin vuosina 2006 ja 2007 kirjekyselyinä.

Vastaava kysely toteutetaan taas **3.10.2008**, ja siihen on saatu Keski-Suomen sairaanhoitopiirin eettisen toimikunnan lupa. Hoidettavien osalta halutaan saada tiedot juuri kartoituspäivältä, kello 8 aamulla vallinneesta tilanteesta.

Kyselylomakkeet tulee lähettää palautuskuoressa (postimaksu maksettu) viimeistään 10.10.2008.

Lisätietoja antaa hygieniahoitaja Maire Liikka, puh. (014) 269 1580.

Kiitollisin yhteistyöterveisin

Maija Rummukainen
Osastonylilääkäri, infektiolääkäri

Maire Liikka
Hygieniahoitaja

Pertti Karppi
Geriatrian ylilääkäri

LIITTEET

Kyselylomake ja täyttöohje

KESKISUOMALAISTEN HOITOPAIKKOJEN HYGIENIAKARTOITUS 3.10.2008

1. Yksikön numero _____

   Yksikkö:_____

2. Osasto: _____

3. Paikkakunta: _____ (kuntakoodi)

3.b Laitostyyppi:_____

Täyttäkää seuraavat kohdat 3.10.2008 klo 8.00 vallinneen tilanteen mukaan.

4. Pitkäaikaishoidossa olevien määrä (yli 3 kk)

1 naiset _____

2 miehet _____

5. Lyhytaikaishoidossa olevien määrä (alle 3 kk)

1 naiset _____

2 miehet _____

6. Käsihuuhteen kulutus kuukaudessa _____ (litraa, yksi desimaali)

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1 virtsatietulehduksen hoitoon _____

2 virtsatietulehdusten estohoitoon _____

3 ihoinfektioihin, haavatulehduksiin _____

4 hengitystietulehduksiin _____

5 muihin tarkoituksiin _____

(Mihin: _____)

8. Kuinka monella potilaalla / asukkaalla on käytössä metenamiinihippuraatti (Hipeksal, Hiprex)? _____

9. Onko käytössänne välineiden huoltoon tarkoitettu desinfioiva huuhtelulaite (esim. Deko)?

1 kyllä
2 ei

10. Kuinka monella potilaalla / asukkaalla on kestokatetri tällä hetkellä? _____

11. Kuinka monella potilaalla / asukkaalla on säännöllistä kerta- tai toistokatetrointia? ____

12. Kuinka monella potilaalla / asukkaalla on käytössä Cystofix? _____

13. Kuinka monta MRSA -kantajaa on tällä hetkellä hoidossa?_____

14. Kuinka monta ESBL -kantajaa on tällä hetkellä hoidossa? _____

15. Tarjotaanko tänä syksynä potilaille / asukkaille influenssarokotetta?

1 kaikille
2 vain osalle
3 ei kenellekään

16. Onko potilaita / asukkaita rokotettu 5 vuoden aikana pneumokokki-rokotteella?

4 kaikkia
5 vain osaa
6 ei ketään

17. Tarjoaako työterveyshuolto tai työnantaja henkilökunnalle influenssarokotetta?

3 kyllä
4 ei

18a. Kuinka moni työntekijä ottaa tänä vuonna influenssarokotteen?
_____

18b. Mikä on hoitopaikan työntekijöiden kokonaislukumäärä?_____

19. Mistä seuraavista aiheista henkilökunta haluaisi lisäkoulutusta?

13 käsihygienia
14 suojainten käyttö
15 työtavat (mm. Dekon käyttö, siivous, aseptinen työjärjestys)
16 neulojen ja terävien esineiden käsittely
17 MRSA- ja ESBL-kantajien hoito
18 eristysperiaatteet
19 potilaiden ja henkilöstön rokotukset
20 bakteeritulehdusten diagnostiikka ja hoito
21 mikrobilääkkeiden käyttö
22 muu aihe, mikä: _____
23 muu aihe, mikä: _____
24 muu aihe, mikä: _____

20. Kuinka monta eristyksessä olevaa Clostridium difficile -potilasta on hoidossa tällä hetkellä? _____

21. Lomakkeen täyttäjän nimi ja puhelinnumero

_____

Muuta tärkeää

Parhaat kiitokset vastauksistanne!

Appendix 2.

Taulukko 1. Virtsatietulehdusten hoitoon ja ehkäisyyn suositeltavat mikrobilääkehoitojen vaihtoehdot Keski-Suomen sairaanhoitopiirin alueen vanhusten hoitopaikoissa.

Kohde	Mikrobilääke	Annostus	Hoidon kesto
Rakkotulehdus	Nitrofurantoiini	75 mg x 2	5-7 vrk
	Pivmesillinaami	200 mg x 3 tai 400 mg x2	5-7 vrk
	Trimetopriimi	160 mg x 2 tai 300 mg x1	5-7 vrk
Jos edelliset eivät käy tai mikrobi resistentti niille	Norfloksasiini	400 mg x 2	7 vrk
	Siprofloksasiini	250 mg x 2	7 vrk
	Kefaleksiini	500 mg x 2	7 vrk
Pyelonefriitti (kuume, CRP yli 50)	Norfloksasiini	400 mg x 2	7-14 vrk
	Siprofloksasiini	500 mg x2	7-14 vrk
Estolääkitys	Trimetopriimi	100 mg iltaisin	3-6 kk
	Nitrofurantoiini	50-75 mg iltaisin	3-6 kk
Toissijainen estolääkitys	Metenamiinihippuraatti	1 g x 2	3-6 kk

Taulukko 2. Keuhkokuumeen hoitoon suositeltavat mikrobilääkehoitojen vaihtoehdot Keski-Suomen sairaanhoitopiirin alueen vanhusten hoitopaikoissa.

Kohde	Mikrobilääke	Annostus	Hoidon kesto
Pneumonia	V-penisilliini	1 milj.ky x 4	7 vrk
	Amoksisilliini	500 mg x 3	7 vrk
	Doksisykliini	100 mg x 2	7 vrk
Usein hyvä vaihtoehto, mutta lihaksensisäinen	Prokaaiinipenisilliini	1,5 milj. ky x 1 i.m.	7 vrk

Taulukko 3. Ihoinfektioiden hoitoon suositeltavat mikrobilääkehoitojen vaihtoehdot Keski-Suomen sairaanhoitopiirin alueen vanhusten hoitopaikoissa.

Kohde	Mikrobilääke	Annostus	Hoidon kesto
Haavainfektiot	Kefaleksiini	750 mg x 2	7 vrk
	Kloksasilliini	500 mg x 4	7 vrk
	Klindamysiini	300 mg x3	7 vrk
Ruusu	Prokaiinipenisilliini +	1,5-3 milj. ky. i.m.	kerta-annos
	V-penisilliini	1 milj. ky x 4	21 vrk
Vyöruusu	Asikloviiri	800 mg x 5	5 vrk

Taulukko 4. Keski-Suomen sairaanhoitopiirin alueen vanhusten hoitopaikkoihin suositeltava 15 mikrobilääkkeen lista.

Mikrobilääke	**Huomattavaa**
Nitrofurantoiiini	Ei jos krea yli 150
Pivmesillinaami	
Trimetopriimi	
Metamiinihippuraatti	Ei varsinainen mikrobilääke.
V-penisilliini	
Amoksisilliini	
Doksisykliini	Tehoaa myös mykoplasmaan ja klamydiaan
Kefaleksiini	
Prokaiinipensilliini	Pistettävä lihakseen
Kloksasilliini	
Klindamysiini	
Norfloksasiini	
Siprofloksasiini	
Metronidatsoli	Clostridium difficile -ripulin hoitoon
Asikloviiri	Pian vyöruusun toteamisen jälkeen

Healthcare associated infections, antimicrobial resistance, antibiotic use and infection control resources in European long term care facilities

LAITOSLOMAKE

Huomautus: Jokaisen tutkimukseen osallistuvan laitoksen on täytettävä laitoslomake, joka on välttämätön tutkimuksen onnistumiselle. Tällä lomakkeella kerätään tärkeää rakenteellista ja toiminnallista tietoa laitoksista, samoin kuin laitoksen yhteenlasketut nimittäjätiedot. **On suositeltavaa, että lomakkeen täyttää laitoksen johtaja tai infektiontorjuntatoiminnasta vastaava henkilö (esimerkiksi hygieniahoitaja).**

A – Laitoksen yleiset tiedot

Tutkimuspäivä ⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋ ⌊2⌋⌊0⌋⌊1⌋⌊0⌋

Laitoksen tutkimusnumero (*Kansallisen HALT-koordinaattorin osoittama*) ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋

Laitoksen omistaja ☐ *Yksityinen* ☐ *Julkinen*

Laitoksessa sairaanhoitaja saatavilla ympäri vuorokauden ☐ *Yes* ☐ *No*

Laitoksen:

Laitoksen asukashuoneiden kokonaismäärä ⌊_⌋⌊_⌋⌊_⌋⌊_⌋ *Huonetta*

Laitoksen yhden hengen huoneiden kokonaismäärä ⌊_⌋⌊_⌋⌊_⌋⌊_⌋ *Yhden hengen huonetta*

B – Nimittäjätiedot

Tähän nimittäjätietotaulukkoon kootaan osastolomakkeilla kerätyt tiedot laitoksen kaikista asukkaista

Tutkimuspäivänä laitoksessanne (kokonaismäärä):

Vuodepaikat (*laitoksen kaikki vuodepaikat*) ⌊_⌋⌊_⌋⌊_⌋⌊_⌋

Asukkaista sairaalahoidossa (akuuttisairaalassa) ⌊_⌋⌊_⌋⌊_⌋⌊_⌋

Asukkaista sairaalahoidossa (akuuttisairaalassa)

- Vähintään 24 tuntia paikalla olleita asukkaita ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
- Yli 85-vuotiaita asukkaita ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
- Miehiä ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
- Asukkaita, joilla antibioottihoito ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
- Asukkaita, joilla infektion oireita tai löydöksiä ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
- Asukkaita, joilla virtsakatetri ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
- Asukkaita, joilla verisuonikatetri ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
- Asukkaita, joilla painehaavoja ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
- Asukkaita, joilla muita haavoja ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
- Asukkaita, joilla desorientaatiota (aika/paikka) ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
- Asukkaita, jotka pyörätuolissa tai vuodehoidossa ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
- Asukkaita, joille tehty leikkaus edellisen 30 vrk:n aikana ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
- Asukkaita, joilla virtsa/ulosteinkontinenssi ⌊_⌋⌊_⌋⌊_⌋⌊_⌋

C Lääketieteellinen hoito ja koordinaatio

1. Tarjoaako asukkaille lääketieteellistä hoitoa:

☐ *Ainoastaan terveyskeskuslääkäri (TKL)*

☐ *Ainoastaan laitoksen palkkaama lääkäri*

☐ *Molemmat: Sekä TKL että laitoksen palkkaama lääkäri*

2. Jos ainoastaan TKL:t huolehtivat asukkaiden hoidosta, kuinka monta eri TKL:ää tällä hetkellä huolehtii laitoksessanne?

└┴┴┘ *lääkäriä*

3. Johtaako laitoksen lääketieteellistä toimintaa johtava lääkäri (JL)?

☐ *Ei, lääketieteellistä toimintaa ei johdeta (jos ei, siirry kysymykseen 7)*

☐ *Kyllä, johtavan lääkärin tehtävät on osoitettu TKL:lle*

☐ *Kyllä, johtavan lääkärin tehtävät on osoitettu laitoksen palkkaamalle lääkärille*

☐ *Kyllä, laitoksen ulkopuolisen lääkärin toimesta*

4. Kuinka monta tuntia kuukaudessa johtavat lääkärit käyttävät lääketieteellisen toiminnan johtamiseen laitoksessa?

└┴┴┘ *tuntia kuukaudessa*

5. Millaisia tehtäviä johtavat lääkärit suorittavat käytännössä?

☐ *Asukkaiden lääketieteellistä hoitoa*

☐ *Lääketieteellisen päivystyspalvelun järjestelyä (lääketieteellisen hoidon jatkuvuutta)*

☐ *Asukkaiden sairaskertomusten valvonta/tarkistaminen (vaikka asukkailla muu hoitava lääkäri)*

☐ *Laitoksen lääkärien koulutus*

☐ *Laitoksen hoitohenkilökunnan koulutus*

☐ *Laitoksen antibioottikäytäntöjen kehittäminen*

☐ *Laitoksen hoitokäytäntöjen kehittäminen*

☐ *Laitoksen infektiontorjuntakäytäntöjen kehittäminen*

☐ *Laitoksen rokotuskäytäntöjen koordinointi*

☐ *Lääkärikokousten järjestäminen lääketieteellisten käytäntöjen yhdenmukaistamiseksi*

☐ *Lääketieteellisten toimintojen vertaisarviointi laitoksessa*

6. Voivatko seuraavat henkilöt konsultoida laitoksen kaikkien asukkaiden sairaskertomuksia?

Laitoksen johtava lääkäri	☐ Kyllä	☐ Ei
Hoitohenkilökunta	☐ Kyllä	☐ Ei

D – Laitoksen infektiontorjuntakäytännöt

1. Vastaako laitoksen infektiontorjunnasta tehtävään koulutettu henkilö?

☐ Kyllä ☐ Ei

2. Jos kyllä, mihin ammattiryhmään infektiontorjunnasta vastaava henkilö(t) kuuluu?

☐ *Sairaanhoitaja*

☐ *Lääkäri*

☐ *Molemmat: sairaanhoitaja ja lääkäri*

Työskenteleekö/työskelevätkö nämä henkilöt:

☐ *Laitoksessanne*

☐ *Laitoksen ulkopuolella*

3. Jos infektiontorjunnasta vastaa lääkäri, mikä on hänen erikoisalansa?

☐ *Kliininen mikrobiologia*

☐ *Infektiolääkäri, jolla on sairaalahygienian erikoispätevyys*

☐ *Infektiolääkäri*

☐ *Epidemiologi*

☐ *Yleislääketiede*

☐ *Muu*

4. Mitä seuraavista laitoksessa toteutetaan?

☐ *Hoitohenkilökunnan koulutus infektioiden torjuntaan*

☐ *Lääkäreiden koulutus infektioiden torjuntaan*

☐ *Hoitokäytäntöjen kehittäminen*

☐ *Moniresistenttien mikrobien kantajien rekisteröinti*

☐ *Epidemiaselvitysten ja -raportoinnin kohdentaminen vastuuhenkilölle*

☐ *Seurantapalaute hoitohenkilökunnalle/lääkäreille*

☐ *Hoitovälineiden desinfektion ja sterilisaation valvonta*

☐ *Eristys- ja muista suojatoimenpiteistä päättäminen moniresistenttien mikrobien kantajien tapauksessa*

☐ *Influenssarokotteen tarjoaminen kaikille asukkaille*

☐ *Käsihygienian toteutumisen seuranta ja palaute*

☐ *Organisation, control, feedback of an audit of infection policies and procedures (on regular basis)*

5. Onko laitoksessa infektiotoimikunta/hygieniatoimikunta (joka vastaa yhdestä tai useammasta laitoksesta)?

☐ Kyllä ☐ Ei

6. Kuinka monta kertaa kyseinen toimikunta kokoontui viime vuonna?

Viime vuoden kokousten lukumäärä ⌊_⌋⌊_⌋⌊_⌋ *kokousta viime vuonna*

7. Onko laitoksessa saatavilla asiantuntija-apua infektiontorjuntaan?

☐ Kyllä ☐ Ei

8. Onko laitoksessa saatavilla kirjalliset ohjeet:

☐ *MRSA-kantajuudesta?*

☐ *Käsihygieniasta?*

☐ *Virtsakatetreista?*

☐ *Verisuonikatetreista?*

☐ *Enteraalisesta ravitsemuksesta?*

9. Tehdäänkö laitoksessa systemaattista hoitoon liittyvien infektioiden seurantaa? *(Vuosittainen raportti virtsatieinfektioista, hengitystieinfektioista jne...)*

☐ Kyllä ☐ Ei

10. Mitä seuraavista käsihygieniatuotteista laitoksessa käytetään?

☐ *Alkoholikäsihuuhdetta*

☐ *Alkoholikäsipyyhkeitä*

☐ *Nestesaippuaa (antiseptinen tai muu)*

☐ *Palasaippuaa*

11. Alkoholikäsihuuhteen kulutus viime vuonna
Litraa viime vuonna ⌊_⌊_⌊_⌋

12. Järjestettiinkö viime vuonna käsihygieniakoulutusta, johon osallistui laitoksen koko hoitohenkilökunta?

☐ Kyllä ☐ Ei

E – Antibioottikäytännöt

1. Minkä alojen lääkärit määräävät antibiootteja laitoksessa?

ARVIO % KAIKISTA ANTIBIOOTTIMÄÄRÄYKSISTÄ

- ☐ *Yleislääkäri/Terveyskeskuslääkäri* ⌊⌋⌊⌋⌊⌋ %
- ☐ *Laitoksen palkkaama lääkäri* ⌊⌋⌊⌋⌊⌋ %
- ☐ *Ulkopuolinen erikoislääkäri* ⌊⌋⌊⌋⌊⌋ %
- ☐ *Laitoksen palkkaama lääkäri* ⌊⌋⌊⌋⌊⌋ %

2. Onko laitoksessa määritelty 'sallittujen/kiellettyjen antibioottien' lista? *(anbiootin määrääminen vaatii erityisen luvan tai niitä ei käytetä lainkaan)*

☐ Kyllä ☐ Ei

3. jos rajoituksia on, minkä antibioottien käyttöä on rajoitettu?

- ☐ *Karbapeneemit*
- ☐ *Kolmannen polven kefalosporiinit*
- ☐ *Fluorokinolonit*
- ☐ *Vankomysiini*
- ☐ *Mupirosiini*
- ☐ *Glykopeptidit*
- ☐ *Laajakirjoiset antibiootit*
- ☐ *Suonensisäiset antibiootit*
- ☐ *Muu*

4. Mitä seuraavista käytännöistä laitoksessa toteutetaan?

- ☐ *"Antibioottitoimikunta"*
- ☐ *Säännöllinen vuosittainen koulutus antibioottien määräämisestä siitä vastaaville henkilöille*
- ☐ *Kirjalliset ohjeet laitoksessa suositelluista antibioottikäytännöistä*
- ☐ *Seurantatietoa vuosittaisesta antibioottikulutuksesta antibioottiryhmittäin*
- ☐ *Sopivimman antibiootin valitseminen mikrobiologisten näytteiden perusteella*
- ☐ *Paikalliset (maakunta/lääni) raportit lääkeresistenssiprofiilista*
- ☐ *Erityisluvan pyytäminen määrätyltä henkilöltä rajoitettujen antibioottien määräämiseksi, joita ei laitoksen peruslääkevalikoimassa*
- ☐ *Laitoksen peruslääkevalikoiman ulkopuolisen antibiootin määräämiseen/valintaan saatavilla ohjeita farmaseutilta*
- ☐ *Peruslääkevalikoima, jossa määritelty lista antibiooteista*
- ☐ *Palaute yleis-/terveyskeskuslääkäreille laitoksen antibioottikulutuksesta*

5. Jos laitoksessa on kirjallisia hoito-ohjeita, ovatko ne:

☐ *Hengitystieinfektioista?*

☐ *Virtsatieinfektioista?*

☐ *Haava- ja pehmytkudosinfektioista*

6. Tehdäänkö laitoksessa liuskatestejä virtsatieinfektioiden havaitsemiseksi?

☐ *Säännöllisesti*

☐ *Ajoittain*

☐ *Ei koskaan*

7. Tehdäänkö laitoksessa systemaattista mikrobilääkekulutuksen seurantaa (seuranta ja palaute kulutuksesta)?

☐ Kyllä ☐ Ei

8. Tehdäänkö laitoksessa systemaattista resistenttien mikrobien seurantaa ?

(Vuosittainen raportti MRSA:sta, C. difficilestä jne...) ☐ Kyllä ☐ Ei

F – Miten tutkimus toteutettiin laitoksessanne?

1. Kuka suoritti HALT-tutkimuksen tiedonkeruun?

☐ *Laitoksen lääkäri*

☐ *Sairaanhoitaja*

☐ *Muu henkilö*

2. Jos tiedonkeruuseen ei osallistunut lääkäriä, validoiko lääkäri myöhemmin datan?

☐ Kyllä ☐ Ei

Kiitämme teitä osallistumisestanne HALT-projektiin!

ASUKKAAN TUTKIMUSNUMERO ☐☐☐☐

Healthcare associated infections, antimicrobial resistance, antibiotic use and infection control resources in European long term care facilities

ASUKASLOMAKE

Asukas

SUKUPUOLI	☐	*Mies*	☐	*Nainen*
SYNTYMÄVUOSI		☐☐☐☐		(VVVV)
ASUMISAIKA LAITOKSESSA	☐	*alle vuosi*		
	☐	*1 vuosi tai enemmän*		
SISÄÄNOTTO SAIRAALAAN VIIMEISTEN 3 KK:N AIKANA	☐	*Kyllä*	☐	*Ei*
LEIKKAUS VIIMEISTEN 30 VRK:N AIKANA	☐	*Kyllä*	☐	*Ei*
ASUKKAALLA:				
- VIRTSAKATETRI	☐	*Kyllä*	☐	*Ei*
- VERISUONIKATETRI	☐	*Kyllä*	☐	*Ei*
- VIRTSA- JA (TAI ULOSTEINKONTINENSSI)	☐	*Kyllä*	☐	*Ei*
- HAAVOJA:				
- PAINEHAAVOJA	☐	*Kyllä*	☐	*Ei*
- MUITA HAAVOJA	☐	*Kyllä*	☐	*Ei*
- DESORIENTAATIO (aika/paikka)	☐	*Kyllä*	☐	*Ei*
- LIIKKUMINEN	☐	*Kävelee*	☐	*Pyörätuoli* ☐ *Vuodepotilas*

Tutkimuspäivänä asukkaalla:

☐ ANTIBIOOTTIHOITO? → TÄYTTÄKÄÄ SIVU 2

☐ INFEKTION OIREITA TAI LÖYDÖKSIÄ ? → TÄYTTÄKÄÄ SIVUT 3/4
(not present or in incubation at admission)

☐ MOLEMMAT: ANTIBIOOTTIHOITO SEKÄ INFEKTION OIREITA TAI LÖYDÖKSIÄ ?
→ TÄYTTÄKÄÄ KAIKKI SIVUT

Tärkeää:

Merkitkää asukkaan tutkimusnumero jokaiselle erilliselle sivulle (sivun oikeaan yläkulmaan) lomakkeiden sekoittumisen estämiseksi.

B - Antibioottihoito

	Antibiootin – 1	Antibiootin – 2	Antibiootin – 3	Antibiootin – 4
ANTIBIOOTIN NIMI	....	....	....	....
VUOROKAUSIANNOS	....	....	....	....
YKSIKKÖ	☐ *g/ vrk* ☐ *mg/ vrk* ☐ *I.U. / vrk*	☐ *g/ vrk* ☐ *mg/ vrk* ☐ *I.U. / vrk*	☐ *g/ vrk* ☐ *mg/ vrk* ☐ *I.U. / vrk*	☐ *g/ vrk* ☐ *mg/ vrk* ☐ *I.U. / vrk*
ANTOTAPA	☐ *PO* ☐ *IM tai IV* ☐ *Inhalaatio* ☐ *PR*	☐ *PO* ☐ *IM tai IV* ☐ *Inhalaatio* ☐ *PR*	☐ *PO* ☐ *IM tai IV* ☐ *Inhalaatio* ☐ *PR*	☐ *PO* ☐ *IM tai IV* ☐ *Inhalaatio* ☐ *PR*
ANTIBIOOTTIHOIDON TYYPPI	☐ *Profylaksi* ☐ *Sairauden hoito*	☐ *Profylaksi* ☐ *Sairauden hoito*	☐ *Profylaksi* ☐ *Sairauden hoito*	☐ *Profylaksi* ☐ *Sairauden hoito*
ANTIBIOOTTIHOITOA SYY: *Määrittele:*	☐ *Virtsatieinfektio* ☐ *Haava- tai ihoinfektio* ☐ *Hengitystieinfektio* ☐ *Ruoansulatusjärj-estelmän infektio* ☐ *Silmäinfektio* ☐ *Korvan, suun tai nenän infektio* ☐ *Systeeminen infektio* ☐ *Epäselvä kuumeilu* ☐ *Muu*	☐ *Virtsatieinfektio* ☐ *Haava- tai ihoinfektio* ☐ *Hengitystieinfektio* ☐ *Ruoansulatusjärj-estelmän infektio* ☐ *Silmäinfektio* ☐ *Korvan, suun tai nenän infektio* ☐ *Systeeminen infektio* ☐ *Epäselvä kuumeilu* ☐ *Muu*	☐ *Virtsatieinfektio* ☐ *Haava- tai ihoinfektio* ☐ *Hengitystieinfektio* ☐ *Ruoansulatusjärj-estelmän infektio* ☐ *Silmäinfektio* ☐ *Korvan, suun tai nenän infektio* ☐ *Systeeminen infektio* ☐ *Epäselvä kuumeilu* ☐ *Muu*	☐ *Virtsatieinfektio* ☐ *Haava- tai ihoinfektio* ☐ *Hengitystieinfektio* ☐ *Ruoansulatusjärj-estelmän infektio* ☐ *Silmäinfektio* ☐ *Korvan, suun tai nenän infektio* ☐ *Systeeminen infektio* ☐ *Epäselvä kuumeilu* ☐ *Muu*
MISSÄ MÄÄRÄTTY ??	☐ *Samassa laitoksessa* ☐ *Sairaalassa* ☐ *Muualla*	☐ *Samassa laitoksessa* ☐ *Sairaalassa* ☐ *Muualla*	☐ *Samassa laitoksessa* ☐ *Sairaalassa* ☐ *Muualla*	☐ *Samassa laitoksessa* ☐ *Sairaalassa* ☐ *Muualla*
KUKA MÄÄRÄNNYT ??	☐ *Yleislääkäri* ☐ *Erikoislääkäri* ☐ *Farmaseutti* ☐ *Sairaanhoitaja* ☐ *Muu*	☐ *Yleislääkäri* ☐ *Erikoislääkäri* ☐ *Farmaseutti* ☐ *Sairaanhoitaja* ☐ *Muu*	☐ *Yleislääkäri* ☐ *Erikoislääkäri* ☐ *Farmaseutti* ☐ *Sairaanhoitaja* ☐ *Muu*	☐ *Yleislääkäri* ☐ *Erikoislääkäri* ☐ *Farmaseutti* ☐ *Sairaanhoitaja* ☐ *Muu*
VIRTSA TUTKITTU LIUSKATESTILLÄ ENNEN ANTIBIOOTTIHOITOA ?	☐ *Ei* ☐ *Kyllä*	☐ *Ei* ☐ *Kyllä*	☐ *Ei* ☐ *Kyllä*	☐ *Ei* ☐ *Kyllä*
VILJELYNÄYTE OTETTU ENNEN ANTIBIOOTTIHOITOA?	☐ *Ei* ☐ *Kyllä*	☐ *Ei* ☐ *Kyllä*	☐ *Ei* ☐ *Kyllä*	☐ *Ei* ☐ *Kyllä*

Mikrobilöydökset

MIKROBIN NIMI (käytä koodilistaa)	|_|_|_|_|_|_|	|_|_|_|_|_|_|	|_|_|_|_|_|_|	|_|_|_|_|_|_|
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Infektion oireita tai löydöksiä

VIRTSATIEINFEKTIO

- ☐ Kuume (> 38°C)
- ☐ Vilunväristyksiä
- ☐ Uusi tai lisääntynyt polttava kipu virtsatessa
- ☐ Lisääntynyt virtsaamistiheys
- ☐ Lisääntynyt virtsaamistarve
- ☐ Uusi kipu tai arkuus rakon seudussa
- ☐ Muutos virtsan hajussa, värissä tai kirkkaudessa
- ☐ Heikentynyt henkinen tai toiminnallinen tila (voi olla myös uusi tai lisääntynyt inkontinenssi)
- ☐ Hoitavan lääkärin diagnoosi

IHOINFEKTIO

Selluliitti, pehmytkudos- tai haavainfektio

- ☐ Märkäeritys haavasta, iholta tai pehmytkudoksista
- ☐ Kuume (> 38°C)
- ☐ Heikentynyt henkinen tai toiminnallinen tila
- ☐ Uusi tai lisääntynyt kuumotus alueella
- ☐ Uusi tai lisääntynyt punoitus alueella
- ☐ Uusi tai lisääntynyt turvotus alueella
- ☐ Uusi tai lisääntynyt kipu/arkuus alueella
- ☐ Uusi tai lisääntynyt seröösi eritys alueella
- ☐ Hoitavan lääkärin diagnoosi
- ☐ Hoidoksi käytetty paikallisantibioottia (voidetta tms.)

Ihon sieni-infektio

- ☐ Iholta koholla oleva punoittava ihottuma
- ☐ Lääkärin diagnoosi tai laboratoriovarmistus

Herpes simplex- tai Herpes zoster-infektio

- ☐ Rakkulainen ihottuma
- ☐ Lääkärin diagnoosi tai laboratoriovarmistus

Syyhy

- ☐ Iholta koholla oleva punoittava ja/tai kutiava ihottuma
- ☐ Lääkärin diagnoosi tai laboratoriovarmistus

HENGITYSTIEINFEKTIO

Nuhakuume/nielutulehdus

- ☐ Nenän räkäisyys tai aivastelu
- ☐ Nenän tukkoisuus
- ☐ Kurkkukipu/käheys tai nielemisvaikeus
- ☐ Kuiva yskä
- ☐ Arat tai suurentuneet kaulan imusolmukkeet
- ☐ Hoitavan lääkärin diagnoosi

Influenssankaltainen tauti

- ☐ Kuume (> 38°C)
- ☐ Vilunväristyksiä
- ☐ Uusi päänsärky tai silmäsärky
- ☐ Lihassärky
- ☐ Pahoinvointi tai ruokahaluttomuus
- ☐ Kurkkukipu
- ☐ Uusi tai lisääntynyt kuiva yskä
- ☐ Hoitavan lääkärin diagnoosi

Keuhkokuume tai muu alahengitystie-infektio (Keuhkoputkentulehdus jne.)

- ☐ Keuhkoröntgenkuvan tulkinnassa keuhkokuume, todennäköinen keuhkokuume tai infiltraatti. Jos aikaisempi keuhkokuva on vertailussa, infiltraatin tulee olla uusi.
- ☐ Uusi tai lisääntynyt yskä
- ☐ Uusi tai lisääntynyt yskösten eritys
- ☐ Kuume (> 38°C)
- ☐ Rintakipu syvään hengittäessä
- ☐ Uusia tai lisääntyneitä löydöksiä keuhkojen tutkimuksessa (ritinät, rahinat, vinkunat tai bronkiaalinen hengitysääni)
- ☐ Hengenahdistus tai hengitystaajuus > 25/min
- ☐ Heikentynyt henkinen tai toiminnallinen tila

- ☐ Hoitavan lääkärin diagnosoima pneumonia (perustuen auskultaatiolöydöksiin)
- ☐ Hoitavan lääkärin diagnosoima muu alempien hengitysteiden infektio

Infektion oireita tai löydöksiä

MAHA-SUOLIKANAVAN INFEKTIO

- ☐ Ripuli: vähintään kaksi löysää tai vetistä ulostusta 24 tunnin sisällä
- ☐ Vähintään kaksi oksennusta 24 tunnin aikana
- ☐ Ulosteviljely positiivinen (Salmonella, Shigella, E. coli 0157:H7, Kampylobakteeri, Clostridium difficile) ja/tai toksiinitesti positiivinen (C. difficile)
- ☐ Pahoinvointi
- ☐ Vatsakipu tai -arkuus
- ☐ Lääkärin diagnoosi tai laboratoriovarmistus

SILMÄ-, KORVA-, NENÄ- TAI SUUINFEKTIO

Konjunktiviitti

- ☐ Silmän/silmien märkäeritys vähintään 24 tunnin ajan
- ☐ Uusi tai lisääntynyt silmän sidekalvon punoitus, johon liittyy tai ei liity kutinaa ja kipua, vähintään 24 tunnin ajan
- ☐ Lääkärin diagnoosi tai laboratoriovarmistus

- ☐ Hoidoksi käytetty paikallisantibioottia (tippoja, voidetta tms.)

Korvainfektio

- ☐ Uusi eritys korvasta/korvista. (Jos eritys on kirkasta, edellytetään muita samanaikaisia oireita kuten kipua ja punoitusta)
- ☐ Lääkärin diagnoosi tai laboratoriovarmistus

Suun tai suun alueen infektio

- ☐ Lääkärin diagnoosi tai laboratoriovarmistus

Sinuiitti

- ☐ Lääkärin diagnoosi tai laboratoriovarmistus

YLEISINFEKTIO

Primaarinen veriviljelypositiivinen infektio

- ☐ Sama taudinaiheuttaja kasvaa vähintään kahdessa veriviljelyssä
- ☐ Taudinaiheuttaja kasvaa vain yhdessä veriviljelyssä ja laboratorion tulkinta ei ole kontaminaatio
- ☐ Kuume (> 38°C)
- ☐ Uusi hypotermia (< 34.5°C)
- ☐ Systolinen verenpaine laskee >30 mmHg perustasosta
- ☐ Heikentynyt henkinen tai toiminnallinen tila
- ☐ Lääkärin diagnoosi tai laboratoriovarmistus

SELITTÄMÄTÖN KUUME-EPISODI

- ☐ Vanhuksella todetaan kuumetta (> 38°C) kahdessa tai useammassa 12 tunnin välein tehdyssä mittauksessa 3 vuorokauden aikana syyn ollessa tuntematon (infektio tai ei infektio)
- ☐ Lääkärin diagnoosi tai laboratoriovarmistus

☐ MUU

mikä